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Quebec Organization Aims to Prevent Labor Troubles

THE Catholic and National Workers' Syndicate has been organized with a view to preventing labor troubles in the building trades of the Province of Quebec. Montreal, in particular, was the scene in 1919 of many labor disputes which interrupted building operations and resulted in losses to employers and men. The idea of the Syndicate is to secure more amicable relations. and to make agreements which will obviate strikes and threats of strikes, and which will be fair to all parties.

Abbe Edmour Hebert, director of social service for the parish of L'Enfant Jesus, is the moving spirit of the organization in its application to industrial conditions in Montreal. Working on behalf of employees he has, we are informed, drafted agreements which are acceptable to them and to the employers, and which are now operative in a number of industrial establishments in Montreal. Whether it will be possible to devise a scheme along lines similar to those which these firms have in operation to embrace all the building trades and their mechanics is another matter.

A draft of an agreement has been submitted to Abbe Hebert by the Master Plumbers' Association for the working of their trades, and he has signified his approval of it, and hopes to secure the assent of the journeymen plumbers and steamfitters to its items. The Builders' Exchange have invited Abbe Hebert to meet a committee of theirs composed of two representatives from each of the trades included with the Exchange to discuss hours, wages and working conditions for the season of 1920. The two most important principles that underlie the agreements put forward by the Catholic and National Workers' Syndicate are full and free recognition of the "open shop" and the classification of workers in the matter of wages according to their skill and experience.

Builders in Municipal Councils Will Exert Good Influence

AMONG the men running for municipal honors at the New Year's elections in Toronto, there were four connected with the building trades. Mr. Samuel McBride, who gave Mr. T. L. Church a close run for the mayorality, is a wholesale lumber dealer; Mr. Jas. Phinnemore, who was elected alderman in Ward 5, is a painter and decorator; F. R. Maxwell, who was elected in Ward 8, is a plumber, as is also Mr. Louis Legrow, one of the candidates in Ward 4.

A meeting was called in the Builders' Exchange on the evening of the 30th, when these four gentlemen told the members something of the platforms on which they were appealing to the electors. Mr. Gander was in the chair. Mr. W. E. Dillon spoke a word for Messrs. Phinnemore and Maxwell, making reference to the good work they had done on the Joint Industrial Council of the Toronto Building Trades.

It is fortunate for the building men of Toronto that they have two men from their ranks, Messrs. Phinnemore and Maxwell, elected to the city council, and it is, we are sure, equally fortunate for the ratepayers in general. Much of the discussion, in Toronto and other municipal councils, regarding matters connected with the building trades, has shown a woeful ignorance of actual conditions and a complete lack of appreciation of builders' problems. Messrs. Maxwell and Phinnemore, as men with practical experience, will have a sound viewpoint and should exercise a wholesome influence upon the attitude of the city council towards matters connected with contracting and construction work.

Montreal City Improvement League Discusses Housing

AT the annual meeting of the Montreal City Improvement League the formation of a company, to operate under the Quebec Housing Law, together with proposed amendments to the Act, was discussed. A communication was read from Mr. E. R. Decary, chairman of the City Administrative Commission, in which he stated that the Housing Law was not drafted in such a way that it would be advantageous to the City of Montreal. Mr. Decary also stated that certain amendments had been sent to Quebec, and that recently he had added a few more, and hoped that if the necessary changes in the law were made, steps would be taken at the begin-

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ning of next spring to take advantage of the Provincial Government's offer.

The report of the president, Mr. F. W. Stewart, stated that the work of applying the law to a city the size of Montreal had not been easy, but by co-operation, he believed they had arrived at a satisfactory set of amendments to the provincial Housing Law which would be presented to the Quebec Legislature within a few days. These would safeguard the interests of the individual lot owners of the working and low-salaried classes, as contemplated by the spirit of the Housing Act, while in addition to this individual building there would be encouraged the erection by co-operative effort of community centres on the garden city plan of England.

Mr. John Baillie, who presided in the absence of Mr. F. W. Stewart, criticized the scheme stating that he believed that, while the law would be advantageous to smaller towns, it would not be practicable in a city the size of Montreal.

Mr. A. S. Clarson stated that if the scheme had succeeded in large cities like Manchester and Birmingham, he did not see why it would not be successful in Montreal.

Association to Urge Wage Payments Based on Production

BELIEF that the time has come when some effective action should be taken to stop the general tendency toward the curtailment of output, is responsible for the formation of the Open Shop Association of San Antonio, which was organized a short time ago. It includes all employers of labor—contractors, manufacturers, hotel keepers, and merchants.

Since the pre-war days, the local wage scales have been greatly advanced, just as in all other sections. With higher pay came less production in many instances, and when still greater demands were made by the unions in some of the building trades, it was felt that a decisive stand should be taken to protect the public against an unjustified increase in wages. Accordingly, for the first time in the history of the city, the contractors of San Antonio organized an association, which after a thorough study of the matter adopted a resolution stating that "there is no just reason for an increase in carpenters' wages at the present time."

Ready to Pay for Efficiency

Contractors were not opposed to paying wages higher than those called for by the old scale—that was shown by the fact that even then many first class carpenters were receiving more pay because they earned it. But they were unwilling to grant an increase affecting all carpenters alike, irrespective of their ability and output. The general decrease in production within the last two or three years was brought out in the resolution referred to above, in these words:

"The average daily records of all the general contractors show that the output of the average carpenter at $6.00 a day is approximately 50 per cent. less than his output when he was receiving but $4.00 a day; in other words, the average carpenter in July, 1917, at $4.00 a day, actually placed from 800 to 1,000 board feet of lumber a day, while at the present time at $6.00 a day the average daily output per man is only from 400 to 750 board feet."

Later, the bricklayers and plasterers were called out in an attempt to force the contractors to sign an agreement to employ union men exclusively, but work was soon resumed on an open-shop basis. As a result, on one job the production was increased about 30 per cent., while the payroll was lessened.

Organize Open-Shop Association

In order to cope with the labor situation in an adequate manner an open-shop association was formed, in which all classes of employers united. Already the movement has spread to several other Texas cities, and if this propaganda should be circulated throughout the entire country, we are confident the present unrest would soon be over.

Business Papers Represent Excellent Advertising Medium

It is not to be thought that the trade papers exaggerate their importance as advertising mediums, or depreciate other mediums. Nor is it asserted that the trade papers have lifted themselves above the level of other classes of advertising mediums.

But it is manifest that they have advanced far towards the goal of 100 percent advertising efficiency in their particular, and peculiar, field.

Beginning, not so many years ago, further down the scale of efficiency in their field than almost any other advertising medium, their publishers were not long in awakening to their true position, and setting themselves earnestly at the task of business-like reorganization and specific progress.

Rightly, these publishers have endeavored to make their papers useful to the particular lines of business they represent, and to as completely as possible cover those lines. This policy has been so persistently and intelligently pushed that now the high-class trade paper is about as near to being a 100 percent advertising medium as it is humanly possible to expect.

Editorially, these papers have become wonderfully effective as records of progress, exponents of methods and processes, proponents of new tested methods, suggestors of merchandising plans, advisors as to financial as well as manufacturing and selling policies —mediums of exchange for whatever is progressive and vital in all lines affecting their readers.

The trade papers have shown a degree of wisdom in perfecting themselves as advertising mediums quite unique, and also very astute and courageous. They have pursued a policy of restricting their circulation to their specific fields to concerns and individuals directly interesting to their potential advertisers.

The cost of producing a really good trade paper is several times its subscription price, making its production a charge upon advertising income, and consequently creating an automatic obligation to the advertisers. This is recognized by the publishers by their policy of securing as readers as nearly all of the men who have to do with purchasing and consumption as is possible, and refraining from attempts to spread circulation beyond those classes. They do not refuse to accept subscriptions from people whose interest may be purely technical, or educational, but their efforts do not run in that direction.

The high-class trade paper of to-day is more nearly

Canada's Engineers—Marcel Pequegnat

Mr. Marcel Pequegnat, who has just been appointed superintendent of the Water Commission of Kitchener, Ont., succeeding Mr. Henry Hymmen, resigned, is a native of Kitchener. His technical training was obtained at the School of Practical Science, Toronto, from which he graduated in 1908, carrying off the T. Kennard Thomson prize in civil engineering. Another year of college gave him the degree of B.A.Sc. with honors. In 1910 Mr. Pequegnat was resident engineer in charge of pavements in Kitchener. He also obtained, the same year, his Ontario Land Surveyor's certificate, being articled to Mr. H. Johnston, of Kitchener. He was also awarded, the following year, the Dominion Land Surveyor's certificate, and, for a time, was under contract with the Dominion Government for township survey work in Manitoba. In 1912 he became resident engineer with the Water Commission of Kitchener in charge of reservoirs, etc.

In addition to his outside work, Mr. Pequegnat worked hard to keep in touch with the "School," for during the winters of 1909-13 he acted as instructor in drawing there, and it was not until the latter year that he found it necessary to confine himself entirely to his practical engineering work. His appointment, in that year, to the position of assistant city engineer of Kitchener, demanded all his time and forced him to relinquish his university connection. In his capacity as assistant city engineer during the next four years he gained valuable experience in every phase of municipal work.

Following the outbreak of war, Kitchener's municipal work gradually narrowed down the same as with most other municipalities, and during the years 1917-18, Mr. Pequegnat turned to actuarial work. He kept in touch with engineering activities, however, and with his native city, and in consequence when the need arose for a superintendent, Kitchener's Water Commission knew where to lay hands on the right man. May the New Year bring him continued success in his new work.

Mr. Marcel Pequegnat

a perfect advertising medium than any publication in any other field. It is nearly a perfect advertising medium, in respect to its circulation and in respect to its suggestive and advisory service to its readers and advertisers. If it were possible accurately to estimate advertising returns, it would undoubtedly be found that returns from trade-paper advertising run to higher percentages than do those in any other class of mediums.

It is not to be forgotten that the trade-paper field is different from the field of any other class of advertising mediums. It is definitely known—delimited as we may say. The trade-paper publishers are able definitely to appeal to about every individual in their potential fields. Their congregations are within known bounds. They know how many possible readers there are of them, and it is not difficult to locate them all.

The business interests of all possible readers of a given trade-paper are almost identical. The work of the editors can be sharply focussed The work of the publishers is laid out for them. They have that great advantage over publishers of any other class of mediums; and they surely have utilized that advantage to the full.

Program of Convention of Canadian National Clay Products Association

The preliminary program of the 18th annual convention of the Canadian National Clay Products Association has just been issued. The convention is being held at the Prince George Hotel, Toronto, on January 20, 21 and 22. Among the papers which will be read are the following:

Field Tile by F. L. Ferguson, B.S.A., Ontario Agricultural College, Guelph.

Stones in Brick Clay by Joseph Keele, B.Sc., Chief Engineer Ceramic Division, Mines Branch, Ottawa.

Firing Clay Products in Dressler Continuous Muffle Kiln by Conrad Dressler of American Dressler Tunnel Kilns, Inc., New York. Illustrated by lantern slides.

Pyrometers for Tile, Brick and Sewer Pipe Factories by Wm. Printz, Brown Instrument Co., Philadelphia.

Pottery Possibilities in Canada by Millard F. Gibson, Manager National Fireproofing Co., Toronto.

Burning Common Brick in Producer Gas Fire Kiln by George Cutbush, Don Valley Brick Works, Todmorden.

Power Transmission and Material Conveying by a representative of the Goodyear Tire & Rubber, Ltd., New Toronto.

Manufacture of Floor Tile, Roofing Tile, Sanitary Cove, etc., by William Robertson of the Ontario Provincial Clay Products Plant at Mimico.

Modern Methods in Soft Mud Brick Manufacture by William Burgess.

It is expected that papers will be read by D. C. Merkley, Ottawa; H. H. Hallatt, Tilbury; Edward Cornhill, Chatham, and others.

Visits will be made during the convention to several plants west of Toronto, where many new and valuable features are to be seen. Visitors will be taken by special motor cars. Full announcement will be made in the final program.

High Level Bridge at Tansley, Ont.

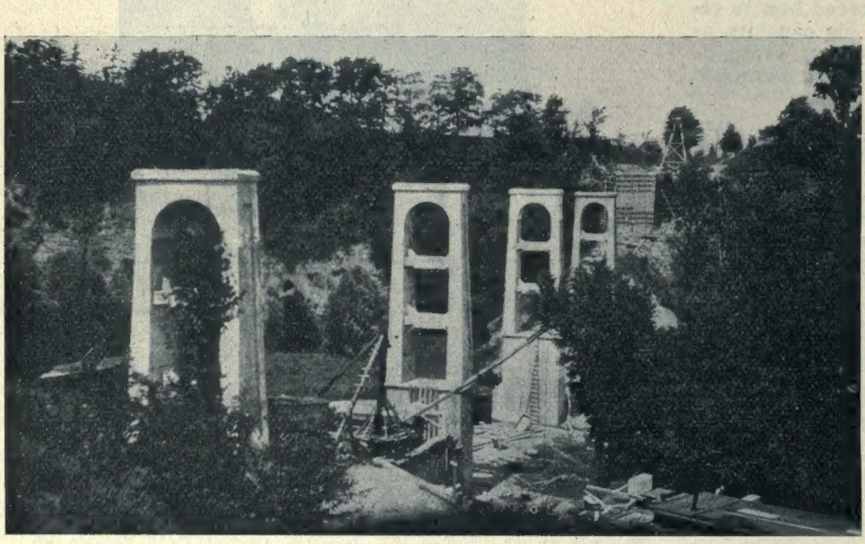
Structure Eliminates 16½ Per Cent Grade Through Deep Ravine—Bridge Comprises Five Latticed Girder Spans of 108 feet Each on Concrete Piers—Girders Placed Without Falsework

By A. W. Connor, B.A.,C.E.*

THE county of Halton has just built a high-level bridge on Dundas St. at Tansley, Ont., over the Twelve Mile Creek. Dundas St. has recently been made a part of the provincial county road system between Toronto and Hamilton. When the Sixteen Mile Creek is also crossed by a high-level structure, Dundas St. will be a leading road between Toronto and Hamilton, being a continuation of the Eaton Road via Cooksville.

The Tansley Ravine is about 650 feet wide and 120 feet deep, and is crossed by a 90 foot steel bridge about 25 feet above the stream, the approaches making a detour down the sides of the hills. These approaches are dangerous and practically impassible in bad weather, being on a curve and grade as high as 16½%. The steel structure built in 1885 is badly rusted and is also too light for the traffic. In March 1917 the writer was instructed to strengthen this bridge, but the day tenders were being opened a section of the old abutment fell out. The council then decided to build a new high level structure from the centre line of Dundas St. on the east to a point about 43 ft. south of Dundas St. on the west in order to shorten the structure by avoiding the cut made by the present road. On the east the new structure was to follow an old cut leading to a previous wooden bridge built about 90 years ago. The writer prepared plans and specifications for several designs using steel arch, steel truss superstructures with concrete substructure and with reinforced concrete arch and precast concrete beam and trestle construction. On account of war time prices, plans were also made for a crossing at an intermediate level and on the line of Dundas without the deviation required for the higher level.

Very little preliminary investigation was required as shale appears on all banks and cuts within a few feet of the surface, and on the river banks. The river is small and shallow, as shown in the illustrations, but in time of freshet fills the whole valley to a depth of 10 to 12 feet. It empties into the lake at Bronte about 4 miles south.



The Tansley Bridge over the 12-Mile Creek, at Tansley, Ont., is a high level structure, comprising five deck latticed girder, spans of 108 feet, supported on concrete piers and abutments. The structure eliminates dangerous 16½ per cent. grades and an old bridge too light for modern traffic. This illustration shows the four piers and west abutment. One tower for the cableway is seen just above the abutment.

Old Railway Girders Used

Tenders were opened on June 20th, 1917, but the prices were considered too high by the Council and action was deferred. A proposition to use old I.C.R. deck latticed girders that had recently been replaced by heavier structures was submitted by Norman McLeod Ltd. of Toronto. On being favorably considered, plans and specifications for the structure now completed were prepared and the contract was awarded to Norman McLeod Ltd. in August 1917.

As shown in the photographs, the superstructure consists of five deck latticed girders of 108′ span, 13′ 6″ centre to centre with concrete floor beams across them and a concrete floor slab 20′ wide clear of curbs. The curbs are 12″ high and the concrete panel railing 4′ high. The substructure consists of concrete abutments and reinforced slab and counterfort wing walls and four concrete piers. The floor of the bridge is about 98′ above low water level and about 20′ below the level of Dundas St. on the west side. This cut will have a maximum depth of about 6′ and be on a grade of 5%. This approach reaches the line of Dundas St. by a reverse curve of 253′ radius. The old cut on the east side was utilized and filled to the new grade of 5%. The maximum depth of fill was 35′. Some of the grading and macadamizing of the approaches will not be completed until spring but the bridge is now open for traffic. The total length of the structure is 542.5′ and with approaches 1450′. It was designed for Class

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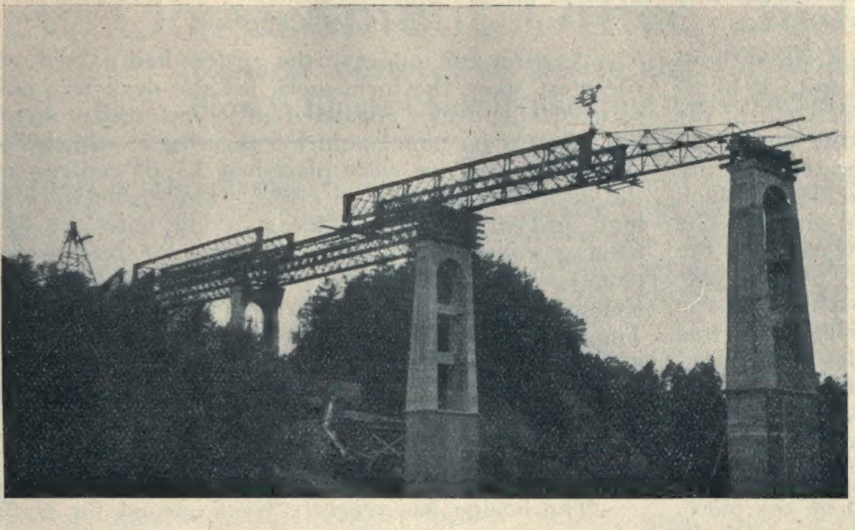
*Of Bowman and Connor, Civil Engineers, Toronto.



One of the interesting features of the construction of the Tansley Bridge was the method of launching the latticed girders without false work. A pilot 60 ft. long was used to carry the girders across the gap. It was handled by the cableway and bolted to the girders just as soon as they were out far enough to allow the pilot to reach the pier. When the girders were in their proper longitudinal position, they were jacked down onto the piers.

C. loading of the Ontario Department of Highways (20 ton concentrated load.)

Contractor's Plant

The contractor's plant consisted of a Florry 5-ton steel cable way about 1000′ long on wooden towers operated from the west bank. The mixer was a steam driven 1-yard Smith mixer with overhead bins fed with a clam shell bucket and discharging into 1-yard hopper bottom buckets under the cable way. The mixer and storage ground for concrete materials was immediately below the higher ground forming the approach to the original bridge. The clam shell derrick, cement shed, tool house and office were located here. The materials were teamed to this point down the old roadway from Tansley station about a quarter mile away.

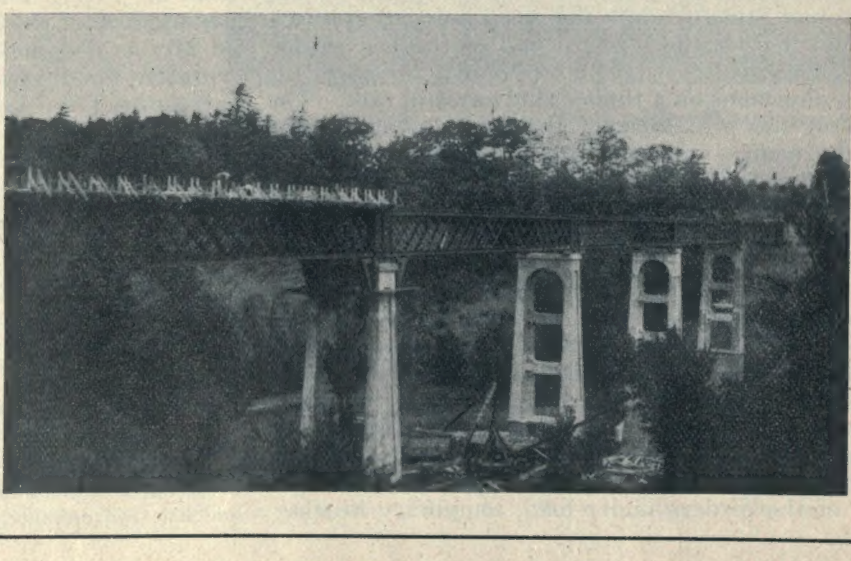
It was found impossible to get suitable local gravel. Crushed stone was supplied by the Canada Crushed Stone Corporation of Dundas, sand by the Maple Sand & Gravel Co., cement by the National Portland Cement Co. of Durham, structural steel by McGregor & McIntyre of Toronto and reinforcing steel by the Trussed Concrete Steel Co., of Walkerville.

The excavation was begun in 1917 at the West abutment, the excavated material being conveyed by the cable way to fill up the deep cut on the east side. No difficulty with water was encountered except in pier 4 in the river and pier 5 on the east bank. A cofferdam of bags filled with earth and fill was constructed for pier 4, which it was found necessary to excavate to 15′ below water level, before hard shale was reached. The steel railway girders were unloaded at Tansley Station. The girders were 108′ long, 9′ 8″ deep back to back of channels and weighed about 20 tons each. The chords consisted of two 12″ channels and 24″ cover plates. The web members consisted of a double system of angles and bars forming 5′ panels. Samples of damaged members of girders that had been subjected to similar service show satisfactory strength. Under a uniform live load of 100 lbs. per square foot, the maximum stress per square inch was found to be 13,100 lbs.

Girders Placed Without Falsework

The girders were brought down to the site lying flat on house moving trucks placed at about the quarter points. They were moved by a team with block and

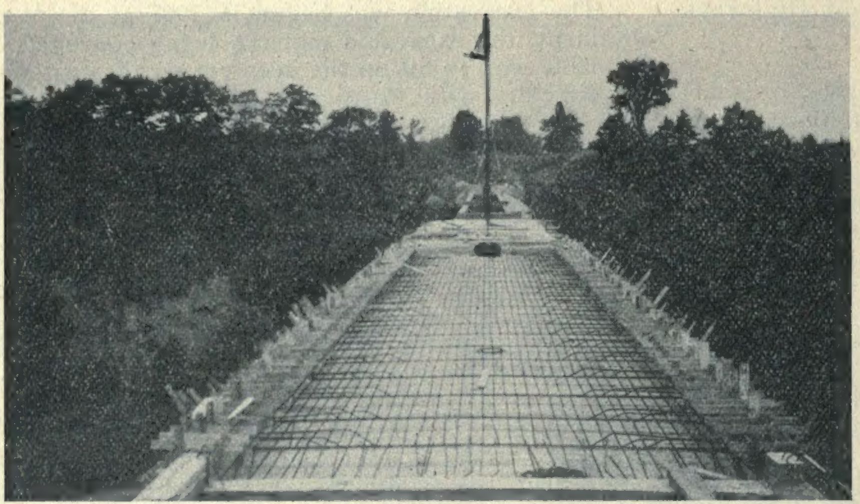
This illustration shows the bridge with the latticed girders in position and the form work for the deck in progress. A 20-ft. roadway makes this bridge sufficiently wide for all traffic requirements.



tackle. They were then set up on the west bank and the new brace frames and laterals assembled and riveted.

The lower part of the piers was 10′ x 20′ without batter and the upper half was battered to 6′ x 16′ 8″ with large openings as shown. The upper half of the pier was cast in three sections, breaking above the struts. The piers were reinforced against temperature stresses only, except the struts and knee braces which were heavily reinforced against wind stress. The launching of the girders, without falsework, was the most interesting feature of the work. A pilot or pair of triangular trusses 60′ long with cross bracing was used to carry the girders across the opening. It was bolted on to the end of the girders and securely tied to the shoe plates. The pilot was handled by the cable way and connected as soon as the girders were out far enough to allow the pilot to reach the pier.

A pair of steel 30 ton rollers were placed on the forward pier to reduce friction or strain on the piers.



The deck form work and reinforcing is shown in this illustration. The deck consists of reinforced concrete floor beams on panel points at 5-ft. centres with a 7½-in. slab. The deck is 20 ft. clear of curbs. The railing is of pre-cast concrete panels.

The girders were moved on greased rails, with shoe plates bolted under the girders and plank between to take up the bearing of the rivet heads. The motive power was supplied by the carriage of the cable way with a series of blocks and tackle. The first girder was pulled from the west abutment by passing a steel cable around same through the weep holes, the others being pulled from the forward end of the last girder placed. The girders were moved down the slope to the west abutment on a timber skidway and rails. On account of the proximity of the cable tower to the west abutment, and also to avoid damaging the ballast wall, a timber bent on concrete foundation was built about 6′ in front of the abutment on which to balance the first girder and also to turn it into the line of the bridge. The pier was built up about 6′ high with 12″ x 12″ timbers, the girders being moved on a slope of 4′. When the girder was moved out to its position it was jacked down to its final level. The next girder was then brought down and run out over those in place and in similiar manner jacked down. The illustrations will show this operation in various stages. In order to give an even bearing of the masonry plates under the uncertain camber of the girders under load, temporary bearing was taken on a 4″ strip of steel and afterwards grouted in.

Deck of Concrete

As soon as the last of the girders had passed over the west span, the form work for the deck was commenced.The deck consisted of reinforced concrete floor beams on panel points 5 ft. c. to c. with a 7½″ slab. The girders were placed at 13′ 6″ centres and the deck was 20′ clear of curbs. The curbs were 12″ high and 10½″ thick and cast along with the deck leaving a chace on top to take the concrete precast panels of the railing; these panels were 2½″ thick. Reinforcing rods for the posts were left projecting. The panels were brought up by cableway and set up in position and forms for posts and upper rails clamped around them and then concreted. At the ends of the girders expansion was provided for by the panels and rails sliding in slots in the posts. On the floor a steel plate with two angles was used.

The bridge has recently been opened for traffic. The work was done on a cost and percentage basis and cost about $110,000.

Mr. J. F. Little is warden of Halton Co. and Mr. Chas. Readhead , Chairman of Bridge Committee. Mr. A. S. Forster was warden in 1918 and Mr. Readhead in 1917. The Department of Highways are paying 60% of the cost. Mr. W. A. McLean appointed Mr. A. Sedgewick and latterly Mr. Jas. A. Bell to represent the department. Norman McLeod Ltd. were the contractors, A. W. Connor the engineer in charge for the county and R. F. Smith, resident engineer.

The Court of Appeal, Montreal, has issued an injunction restraining the construction of a balcony overhanging on a street at St. Johns, P. Q. The Court held that the absence of a municipal building by-law on the subject was no justification for an encroachment on the sidewalk, particularly, as in the present case, where the authorization of the municipality is refused.

Building operations in Quebec city during the year 1919 involved an expenditure in the neighborhood of $2,000,000, which is approximately double the total for the year 1918.

New Government Office Building at Ottawa

General Features of Design and Construction of Nine-Storey Block, Accommodating Government Departments

WHILE the influenza epidemic and unsettled labor conditions impeded the work greatly, the Hunter Building, Ottawa's new Government office building, was completed within the contract time, and one floor was occupied early in August—a little over a year after erection of the steel superstructure was begun. The new building houses four branches of the Government which at present are occupying scattered offices in different parts of the city—the Department of Public Works, the Department of Naval Service, the Department of Marine, and the Civil Service Commission.

The big, new nine-storey block, located on the corner bounded by Queen, O'Connor and Albert streets, is strictly utilitarian. It boasts no "frills," but is eminently suitable for the purpose it is to serve.

Possessing few unusual or novel structural or engineering features, the principal interest attached to its erection has been the fact that the contractors have been able to so well fulfil their contract with respect to the time clause. Influenza and a succession of strikes have hampered the construction practically since the outset. Shortly after the work was well under way, a two-week strike of the Ottawa building trades disrupted Bate-McMahon's organization, while local and other strikes have very seriously delayed receipt of needed materials.

The building cost approximately $1,450,000—the building itself $1,100,000, and the steel super-structure, which was erected by the Dominion Bridge Company, $330,000. It has a frontage of 198 feet on O'Connor street, and of 150 feet on Queen and Albert streets, with a light well 95 feet by 48 feet. Actual office floor space, exclusive of corridors, etc., is 16,400 square feet per floor.

The framework is of skeleton steel construction encased in concrete and carried on steel columns from the foundation rock. All of the steel work is encased in a two-inch coating of concrete.

General Features of Design

The exterior construction comprises a Stanstead granite base to approximately the ground floor level, Manitoba limestone from the Tyndall Quarries for the main and first floors, and Milton faced tapestry brick for the remaining seven stories, with stone trimmings. The brick is backed with interlocking terra cotta tile supplied by the National Fire Proofing Company.

There are three main entrances to the building, one on each of the streets on which it is located. The main entrance halls, on the ground floor, have Mississquoi marble wainscotting and marble floors, while all other halls and corridors have seven-foot cement dadoes finished with white vitrolite enamel and terrazzo floors. At the entrances are located the elevator shafts, each containing two elevators, of which four of the total number are of the traction type, with a speed of 500 feet, and two of the drum type, with a speed of 250 feet. One car of each pair will be used as an express, and the other as a local car.

Partitions are of gypsum, faced wfth hard wall plaster, and office floors are three-quarter inch mastic on four-inch concrete slabs.

Two hydrants are located on every floor, and two fire-proof, enclosed stairways, with hollow metal doors, are located diagonally opposite each other at the two ends of the building. On each floor are also located branches of a vacuum cleaning system, by which all cleaning will be done.

While a section of the basement will be used for offices and for storage of documents, etc., it will be chiefly occupied by the heating and electrical installation, etc., with the boiler room located six feet below the level of the basement proper. Four Leonard boilers, 16 feet long and 72 inches in diameter, stoked by a Gault sprinkler stoker, will heat the building, while ventilating will be done by the Plenum system, air being driven into the corridors by multi-blade fans delivering 25,000 A.P.M. at 70 degrees.

Crushed Nepean Sandstone for Concrete

An interesting feature of the construction of the building was the fact that it served to demonstrate that, with the proper facilities, crushed Nepean sandstone is more suitable than limestone for concrete mix. While this sandstone had been rejected for other Ottawa office buildings, laboratory tests showed it to be higher than limestone for both tensile and compressive strength. Run of crusher was used in the mix, and no sand was required. A sample briquette of the screenings showed higher than Ottawa River sand. However, only a comparatively small quantity of Nepean sandstone was used, owing to the fact that available facilities did not permit of economical extraction.

The Hunter Building, at Ottawa, houses four government departments

The concrete was run in from two towers, located on opposite sides of the building. The mix was

1 :2½ :5; and 1 :2 :4. Smith and Rex chain-drive mixers of half-yard capacity were used.

The building was designed under the supervision of the Chief Architect, Richard C. Wright, of the Department of Public Works, with A. J. Barclay as architect in charge. This branch of the Public Works Department occupies the entire top floor of the building, approximately half of which will be used as a drafting room.

The general contract was executed by Bate, McMahon and Company, with A. Macdonald as superintendent in charge of the work. Sub-contractors included: W. G. Edge, Ltd., heating and ventilation; A. A. Giddings & Co., lighting; Otis-Fensom Elevator Co., Ltd., elevators; Ornamental Iron Co., ornamental iron; McFarlane and Douglas, sheet metal; Canadian H. W. Johns-Manville Co., Ltd., mastic floors; Jas. Walker, marble, terrazzo, and hardware; Peter Baxter, plaster.

Present Conditions in the Waterworks Field

Utility Charges Have Not Increased Like Cost of Giving Service—Delay in Waterworks Improvements

In its report submitted at the recent convention of the American Society of Municipal Improvements, the Committee on Water Supply, of which Mr. Geo. G. Earl is chairman, gives a summary of present conditions in the waterworks field. An abstract of the report follows:

Within the last few years all material and labor required for the construction, maintenance and operation of waterworks systems have advanced very greatly in cost; and in addition, it is the general experience that the amount of labor output per man in most occupations has decreased, all resulting in a very much higher cost per output of service than existed before the war, which has left in its wake many problems of readjustment and reorganization. These increased costs exist not only in water supply systems but in all public utilities.

Public utilities generally are a most important factor in our daily lives, ministering directly to our comfort and convenience and effecting our health. Everyone of them is essential, and rather than eliminate any of them, we could afford to pay for the services which they render a great deal more than their present cost.

Returns for Public Utility Service are Inadequate

Utility charges have not increased, because of contract or other legal limitations, or because of public opposition, in anything like the proportion that the cost of the service which they render has increased. Many of them which are privately owned are in the hands of receivers; many others are struggling for their lives, and very few of them are in a position to extend and maintain their services as they would be if they could always be assured of adequate return for the service which they render.

Years ago, public utility corporations working under franchises of various kinds were regarded as splendid investments, and companies obtaining such franchises often took advantage of their opportunities to over-capitalize such enterprises and to exploit the public, either directly in rates or indirectly by the sale of securities at fictitious values based upon the anticipation of earning power in excess of that which has finally been allowed. Because communities have retained their police powers and their taxing powers and have established authoritative bodies for the government of rates charged, and the establishment of regulations concerning utility enterprises much hope of gross public exploitation in rates has disappeared, and capital is not now to any great extent seeking utility enterprises, since there is no longer a gambling chance of excessive profit in them, and, at present, no assurance of even a fair return. As a general thing, the bodies created for the supervision and regulation of utility enterprises intend to treat them fairly, but there are so many complicating conditions, due to existing contract rates, to franchise conditions, to valuations and taxations, and to various legal complications, and finally to a general public sentiment based on the assumption that private utility corporations have been exploiting the public, for essential readjustment to be made promptly or adequately, and even in the case of municipally owned utilities, there is always the desire on the part of the public to avoid rate increases, and because of this public desire, public authorities avoid or delay rate increases, or are forbidden by law to make them, and find themselves often in just as difficult situations as private corporations.

The fact is that neither publicly owned nor privately owned utilities can be conducted to best advantage until the public, as a whole, grasps the idea, that every service must earn its cost and that the recipient of every item of service should always pay the full average cost of the items of service which he absorbs, leaving no portion of said cost to be carried by any who do not receive a service of some character from said utility. Once this idea is generally admitted, it will be easy to induce capital to invest in privately owned public utilities and to maintain them as well as publicly owned utilities up to any standard of service which the public desires and is willing to pay for.

Study Needed for Proper Classification of Service of Utilities

Much more careful study than is usually given is needed for the proper classification of the actual items of service which utilities perform, and there is a wide scope of discretion or option as to the basic of such classifications, especially in publicly owned utilities. For instance, cities now are tending to a great scattering of population in surrounding suburbs, the cost of a water service for the well built portion of the city for adequate domestic and fire supply for its whole population will be met by a certain definite service charge per meter, and price per 1000 gal. of water supplied and tax on assessed values for surplus capacity for fire protection and increased demand, but if you extend your system to double the mileage of mains required to give adequate service to the reasonably well built portion of the city in order to give possibly one-fifth as many scattered premises the same character of domestic supply and fire protection, it is obvious that your rates per these various units must be higher for all, or else that you must have two or more rates, the one covering the actual cost for the well built sections of the city, and the others the very much higher costs, due to the scattering of population in outlying areas.

Because of the great tendency to scatter population, leaving much unused property sandwiched between occasional improved areas, the actual cost of all municipal improvements and utilities is enormously increased, and property in the well built and thoroughly served sections of many cities is allowed to depreciate in value and usefulness. More carefully and justly arranged schedules of utility rates and schemes of taxation for municipal improvements based always upon the idea that every beneficiary of every service should pay as far as possible the cost of such service, and that the service should only go to those who do pay their share of its cost, would tend strongly toward the checking of premature development of outlying and unnecessary areas, and thus allow the more consistent and thorough development of all services within such areas as are actually required for the comfortable accommodation of the whole population.

Undue Delay in Waterworks Improvements

For several years now conditions have precluded anything more than the most essential extensions and developments of water supply systems, and to-day the cost of material and labor for improvements is in many cases out of all proportion to the rates which are charged for service, with the result that extensions and improvements which the growth and development of our cities really require are being unduly delayed.

Such delays often show no obvious depreciation of service up to a certain maximum or breaking point, and the people who are getting all the service they desire are always skeptical of the necessity for improvements, of which the plant management is painfully aware. Eventually, however, a big fire, with inadequate water supply to provide proper fire protection, or a general increase in insurance rates, or deterioration in the character of the water, because of the overload imposed upon the purification system, and possibly an outbreak of typhoid brings the public to attention, and it is found that large expenditure in improvements are a few years past due and will require that many years to complete in the face of a depreciation service due to the further increasing demand while the improvements are in progress.

Water works especially, and other public utilities as well, are essential, economical and vital factors in public comfort, well being and health that it pays to keep them up to the maximum state of efficiency which the community which they serve can afford to pay for, and that both public owned and privately owned utilities must fail in service, and eventually cease to serve at all, if they are not sufficiently compensated for the service which they render, to permit them to pay living wages to the large number of employees who are engaged in their service, to provide generally better conditions of employment and compensation for their employees than they have heretofore, and to earn their reasonable interest and depreciation and operating costs.

Conditions since 1913 have changed enormously, a new price level has been reached and is tending toward stabilization on a much higher level than then existed. Labor, especially, is and will remain higher; improved methods of production or building and economies or substitutions, it is reasonable to hope, will, in some degree, lower the general cost of living from its present scale, and the cost of utility development as well, but if anything is manifest, it is the common belief that the average man must, in the future, obtain a better opportunity and a better share in the comforts, luxuries and security of life for the service which he renders than heretofore, and if this is to be obtained general wages, relatively, must remain higher than heretofore. It is essential that all available human effort be devoted economically to the production, transportation and distribution of those things which we all need and desire in order that the maximum amount thereof may be available for general use. To the attainment of this end, efficient public utilities of all kinds, earning and guaranteed to each, the full cost of the adequate services which they are required to render, and paying a fair wage to those engaged in their work, are vital, and since we are a democracy in which the voice of the majority must dominate it is essential that the voice be tuned to demand a square deal all around, and nothing will tend more in that direction than a general effort to determine the actual items of service which public utilities render, and their cost, aggregating the whole cost of the service; to whom they are rendered, and see to it that every item of such service is paid for in full by its recipient. Failure to reach this result, as nearly as is humanly possible, means the exploitation of some for the benefit of others with incessant contention and a depreciated service.

Pollution of Public Supplies by Entrance of Water from Fire Protection Systems

In Appendix 4 of the report of the Committee on Fire Protection to the American Waterworks Association at the 1919 convention of the Association, there is a summary of cases in which the public water supplies are believed to have been polluted by the entrance of water from other sources of supply, usually through fire protection systems to particular plants which have been connected with the public water supply, and also with other sources of supply, in such manner as to permit of the possibility of the water from other sources finding its way into the general distribution system.

Many cases of this kind are recorded which are known or believed to have caused considerable outbreaks of typhoid or dysentery, or both.

In the body of the report of this same Committee is a discussion as to the regulations variously adopted to prevent pollution of this character. The least precaution suggested is that wherever dual sources of supply are used, one of which is from the general city supply the connection with the city supply should be made with two successive especially well designed check gates to prevent the possibility of any back flow, said check gates to be placed in a position where they are easily accessible for inspection and repair and to be so arranged that they can be cut off from pressure in either or both directions by positive valves on either side of them, so that each can be independently tested for tightness against back flow by means of proper pressure gage and tap connections, and that such tests for tightness should be made at frequent intervals. There are many, however, who advocate that no such dual connections should exist, but that if the city supply is to be utilized at all, in connection with other sources of supply, it should be drawn into supply tanks through pipe connections discharging freely into the top of tanks with no physical connection whatever between the city supply and other sources of supply.

There is considerable sentiment even that no possibly polluted supply should be piped into or used for any purpose about any plant, because there is always the danger that cross connections may be made somewhere inside of the plant inadvertently or that employees or others about the plant may use water from the wrong source.

It is quite possible that the difference between local conditions in different localities would fully warrant the above noted divergence of views, for instance, if the source or sources of secondary supply were just as attractive in appearance or taste as the city supply, but known to be dangerously polluted, the most extreme precautions would probably be warranted, whereas, if the source or sources of secondary supply were a highly colored or very muddy water so that it would be at once noticeable as compared with the city supply, even in a very small admixture therewith, and especially if said secondary sources of supply were not polluted and, therefore, not dangerous to public health, it would appear that it would be a great hardship and most uneconomical to prohibit their use for such uses as they may be even better adapted for than the city supply, or to condemn those who use them to the repumping of the city water whenever they desire to use the two waters together or interchangeably under a pressure not greater than the city pressure as is often the case in a fire protection system or in plants in which arrangements for dual sources of supply for other uses are found desirable.

Results of Experiments on Activated Sludge Sewage Disposal at Milwaukee

RESULTS of sewage experiments with fine screens, activation tanks and Dorr thickeners at the testing station of the Sewerage Commission of Milwaukee are recorded in the annual report for 1918, reference to which is made in Engineering News-Record. Experiments with fine screens indicated that whereas the volume of liquor treated per square foot of fine screen wet area increased with increasing losses of head, the pounds of screenings removed per million gallons treated decreased. The screen used resembled the Hamburg type but the screenings are swept off by a system of revolving brushes. It is made of 38 bronze plates, 32 x 18 in., each plate having 28 per cent. of open space in the form of slots ⅛ in. wide. The screens were made by the Chain Belt Co. and installed for two purposes: To protect the aeration tanks from the coarse debris, which has proved to be a serious detriment in previous experiments, and to get data on the relative volumes passed, quantity of suspended matter removed and losses of head developed by slots of several sizes.

SEWAGE SCREEN RESULTS WITH VARYING LOSSES OF HEAD

Loss of Head	2 In.	4 In.	5.7 In.	6.7 In.
Sq. ft. wetted area...	22.7	26.2	27.5	28.1
Million gallons treated daily	3.7	7.0	8.0	12.8
Gallons per sq. ft. wetted area	115,200	161,100	202,300	318,700
Pounds of screenings collected daily... ...	3,498	4,500	5,181	5,548
Average per sq. ft. wetted screen area	1,079	1,032	1,320	1,382
Average per million gallons	953	655	650	441
Per cent. moisture in drained screenings ..	88.1	89.0	88.5	88.5
Per cent. rough suspended matter removed	6	9	6	5
Total suspended matter in sewage, p.p.m..	239	219	249	250
Coarse suspended matter in sewage, p.p.m.	193	157	143	127
Coarse suspended matter in screened liquor, p.p.m.	181	149	134	119

The screened effluent passes into aeration or activation tanks having liquid areas of 284 sq. ft. and containing filtros plates guaranteed by the maker to pass, when dry, 10 cu. ft. of air per minute under a pressure equal to 2 in. of water. One of the 15-ft. tanks had 64 plates and the other 48. The two 10-ft. tanks were similarly equipped. From experiments in 1916 and 1917, standards of 90 per cent. removal of bacteria, 95 per cent. of suspended matter and 72 hours of stability of effluent were adopted. The activated-sludge tanks were found to be able to meet these standards, at rates of 7,000,000 gal. per acre daily. The 1918 experiments were for the purpose of doubling the rate. Both 15 and 10-ft. tanks, running at the high rate, met the standard with a margin to spare, 99 per cent, plus of the suspended matter being removed, 95 per cent. plus of the bacteria and the stability was 120 plus and 105 plus in the 15-ft. tanks and 100 plus and 95 plus in the 10-ft. tanks. The screens enabled the rate to be increased to 16,500,000 gallons.

Settling tanks equipped with Dorr thickeners received the mixed liquors discharged by the aeration tanks. Important features in these tanks are as follows: (1) Power-driven mechanical scrapers which travel over the surfaces of the slightly cone-shaped tank bottoms and force the heavy, settled sludge out through a central drain; (2) air lifts which raise the heavy discharged sludge to measuring devices or "tipping trays;" (3) weir troughs by which the purified sewage is drained off from the surfaces of the tanks and discharged into measuring boxes.

The thickeners were installed to serve as settling basins for separating purified sewage from sludge, and to condense the sludge. As the effluent contained less than 5 p.p.m. of suspended matter and the sludge, at times, contained less than 98.5 per cent. of moisture the thickeners were considered to have given good service.

The aeration tank effluents entering the thickeners were applied at an approximate rate of 1,000 gal. per square foot of surface area daily. At this rate, the tanks contained a layer of heavy sludge at the bottom of from 2 ft. to 3 ft. thick, and the top of the sludge blanket was about 8 ft. above the bottom. The scrapers made one revolution in four minutes and moved the sludge from the outer edge to the center in ten minutes.

Analyses of the sludge discharged show that it varied in moisture from 97 to 99.5 per cent. The moisture content is affected to a large degree by the quantity and character of the sludge in the mixed liquors which enter the tanks and by the manner in which the sludge is drawn off.

When the aeration tanks contain much sludge, as, for instance, 25 to 30 per cent. (on one-half hour settling), the moisture in the sludge escaping from the thickeners will range between 97 and 98 per cent.; when the aeration tanks contain 15 per cent. or less of sludge, the thickeners will discharge sludges with 99 to 99.5 per cent. of water. If the sludge is drawn off rapidly, top water breaks through and raises the moisture by dilution. If the sludge is drawn off slowly and continuously, a layer of thick sludge 2 to 3 ft. deep remains on the bottom all of the time and prevents top water from breaking through.

When sludge is drawn off continuously at a rate of 13 per cent. of the sewage flow, the sludge will carry 98 per cent. (or less) of moisture. When the sludge is drawn off continuously at a rate of from 18 to 20 per cent. of the sewage flow, the sludge will carry 98.5 per cent. of moisture. When the sludge is drawn off continuously at a rate of from 30 to 35 per cent. of the sewage flow, the sludge will carry 99 per cent. (or more) of moisture, but when the sludge is drawn off at a rate of 50 per cent. of the sewage flow, the sludge will carry 99.5 per cent. or more of water.

Sooty air on Jones Island clogged the filtros plates. Most of it was removed by filtering through a layer of 12-oz. duck then through a layer of canton flannel and finally by passing through a Nash hydro-turbo blower.

Aeration by perforated black iron pipes was not a success, the holes in the pipes of the grids filling with rust within two days. Filtros plates set in iron containers and fed by black iron pipe lines were covered with sufficient rust in a few months to shut off the air. It is concluded that galvanized iron or some non-corrosive metal should be used to deliver air to the filtros plates.

T. Chalkley Hatton is chief engineer of the commission and W. R. Copeland chief chemist.

Believes in Co-Partnership Housing

Editor, Contract Record:—

I have read with much interest the article describing the housing development at Walkerville, Ont. The architects and others responsible for such a development have certainly proven their deep knowledge of the problem to be solved. I am sorry to say, however, that, in this as well as in many other descriptions, cost prices in detail and rents charged, etc., are not given. Such information would be very valuable to housing reformers. May I say also that I strongly believe that the English co-partnership system could be worked out just as well in this country, if properly explained and understood. It assures mobility of labor and takes away from the mind of the employee all idea of paternalism from his employer. I strongly believe that any model development should be worked out both ways, giving the choice to the tenant to buy his own house or to invest in the undertaking shares to the amount of the house he lives in.

Yours very truly,
Emile Nadeau,
Director of Housing for Quebec.

Quebec, Dec. 23, 1919.

Peckover's Limited, New Steel Jobbers, to Establish Large Warehouse in Toronto

ANNOUNCEMENT is made of the formation of a new warehousing, jobbing and importing company in Toronto under the name of Peckover's Limited. For the present temporary premises at the foot of Market Street have been adapted to steel warehousing. They have been fortunate in mill deliveries, for already over a thousand tons are on the way in the line of iron and steel bars, nickel steel, tool steel, galvanized black and automobile sheets, plates, structurals, boiler tubes, etc.

The new premises, which will be ready as soon as possible in 1920, give Peckover's Limited a splendid site of three acres at the foot of Spadina Avenue, which is in the heart of business Toronto and only three or four blocks from the railway freight sheds. Besides a splendid dock they are on three lines, the C.P.R., G.T.R. and C.N.R. In this way they can get water delivery from Algoma, Hamilton, or the mills in Nova Scotia, as well as from U.S. points, and some day from Europe.

The principals in the new company are C. R. Peckover, of the firm of Baines & Peckover, and J. G. Near, for the past eighteen years with the Drummond-McCall Co., of Montreal and Toronto.

Mr C. R. Peckover has been in the steel business in Canada for a long time. He first started at the study of steel in Scranton, coming to Canada about 23 years ago to the Rice Lewis Co., for a year. It was then that he went into business with Mr. Baines as agents for the London Rolling Mills and for the London Bolt and Hinge Works. The firm of Baines & Peckover developed to huge proportions, Mr. Peckover enjoying the confidence of a large clientele on account of his intimate knowledge of the steel business. Mr. Peckover has been a traveller as well as a successful steel merchant, having visited nearly all the large steel mills and best conducted warehouses in America and Europe, looking for information and ideas.

J. G. Near is a Toronto boy, going from school to the Drummond-McCall business some 18 years ago. Mr. Near had much to do with the development of the Drummond-McCall warhouse department, having charge of that work for some years, and latterly in charge of all sales. He is well known to the industrial interests of Ontario particularly.

The new warehouse at the Spadina avenue property will be a model one in every particular, with installations of electric cranes, shears, saws, etc., for the most rapid handling and cutting of steel to length or shape desired. The building will be 200 feet wide by 600 feet long. Round bars will be carried up to 18 in. diameter, I-beams up to 24 in., UM plates to 72 in. wide, with a full stock of angles, channels, tees, merchant bars, sheets and sheared plate advancing in 6 in. widths, and a heavy stock of boiler tubes 1 in. to 4 in.

Associated with Peckover's Limited will be Steel Working Limited, with a full equipment of fabricating shop machinery, which will be in operation in January, under a competent and long-experienced staff in office and shop.

The old firm of Baines & Peckover is dissolved. The new firm of Peckover's Limited is capitalized at half a million, with $300,000 paid-up capital.

General Features of Asphalt Macadam Roads

Recommended Methods of Construction to Ensure Good Service — Attention to Details is Essential

THE term asphalt macadam is used to designate a highway having a wearing course of macadam coated and filled with asphalt applied by the penetration method after the broken stone or similar material has been placed on the sub-grade or foundation. The asphalt macadam pavement is ordinarily laid upon a broken stone foundation but both Telford and concrete foundations may often be used to advantage. Frequently an old existing pavement can be made to serve both as a satisfactory and economical foundation.

Some important recommendations in regard to asphalt macadam pavements are made in a brochure recently issued by the Asphalt Association, from which the matter that follows is abstracted.

Attention to Details Essential

The purpose of this brochure is not to present complete specifications for asphalt macadam pavements but to call attention to the important details of construction by suggesting sound methods and to point out faulty practice which should be avoided and which has been responsible for much unsatisfactory work in the past. It has been frequently noted that the best asphalt macadam laid by an engineer or contractor is his first. When this is so it is due to the fact that owing to his lack of familiarity with such work he at first pays careful attention to the details of construction. The work apparently proves to be so simple and the finished pavement so satisfactory that in subsequent jobs he is apt to slight or lose sight of details which he may consider to be of minor importance but which have a great deal to do with the ultimate satisfactory life of the pavement. Neglect of certain of these details may not appear in the newly completed pavement and resulting defects may not develop for a year or more, at which time the true causes will not likely be understood. In order to obtain a pavement which is uniform and will wear uniformly it is necessary that each square yard be constructed as nearly like every other square yard as possible. Owing to the rapidity of asphalt macadam construction the opportunity for variation is so great that too much emphasis cannot be placed upon this fact. The first rule to observe, therefore, is: construct an asphalt macadam by the square yard and not by the mile.

Foundations

An existing macadam or Telford makes an excellent foundation for asphalt macadam pavements provided it is sufficiently thick and well drained to afford adequate support. Broken stone foundations for ordinary traffic should seldom be less than six inches thick and for heavy traffic should run from 8 to 12 inches in thickness. If, therefore, an old broken stone road is to be utilized as a foundation, test holes should first be dug at frequent intervals to ascertain its thickness, taking into account the fact that some of the broken stone has been forced into the sub-grade.

Old gravel roads may sometimes be utilized as foundations but gravel carrying a high percentage of clay cannot be depended upon to support heavy loads during the early spring north of the frost line, or in localities where the sub-grade is likely to be wet for considerable periods. Old brick, block and concrete pavements make satisfactory foundations provided all bad depressions are first patched with either hot or cold-mix asphaltic concrete.

In the construction of new broken stone foundations it is preferable that the voids should be filled with screenings so as to produce maximum stability. In fact the closer such a foundation approaches the condition of a finished well bonded macadam the more satisfactory will it be. In order to secure this condition it is desirable, when conditions permit, to complete the foundation considerably in advance of laying the asphalt macadam and allow it to take traffic until thoroughly seasoned. During such period it should be carefully maintained so that it will have a smooth well bonded surface upon which the pavement proper may be laid.

Under severe sub-grade or traffic conditions where the advisability of a slab foundation for other types of pavement is apparent no exception should be made in connection with the asphalt macadam. As the serviceability and economic value of this type become more fully recognized it is quite probable that the use of concrete foundations for asphalt macadam will be more widely adopted for highways subjected to heavy truck traffic.

General Features of Asphalt Macadam Construction

The asphalt macadam is laid upon the prepared foundation in a single course of large size broken stone of about the same dimensions and grade as in ordinary macadam construction. A wider range in types of rock may however be allowed owing to the fact that the natural cementing value of the rock may be ignored. After rolling the layer of coarse stone, hot asphalt cement is applied in such quantity as not merely to cover the surface but to flow into the voids between the stone fragments and thus penetrate the entire wearing course. Application of the asphalt cement may be made either with hand pouring pots or mechanical distributors as later described. After such application the surface voids are filled by spreading and rolling in a thin layer of stone chips. All surplus of stone chips and dust is then broomed off of the surface and a second application or seal coat of asphalt cement is made, covered with stone chips and the pavement completed by rolling.

Spreading and Compacting the Coarse Broken Stone

Before laying the pavement all excess dirt and fine material should be swept from the surface of the foundation. This will not only promote a closer bond between pavement and foundation but will tend to prevent the broken stone from becoming coated with dust and thus interfere with the adhesion of the asphalt cement to the surface of individual fragments. As the completed thickness of the pavement is usually made from two to three inches the broken stone should all pass a two inch ring. Wide variations in size, particularly running to small sizes, result in the formation of spots which are so dense that uniform penetration of the asphalt will be hindered or entirely prevented. Such spots although not discernible in the newly finished pavement will ravel and disintegrate under traffic long before the pavement has attained its normal life. For this reason the size of broken stone should be carefully inspected as to suitability.

The broken stone should be shoveled and not dumped in place upon the foundation. The practice of dumping loads where the stone is required and spreading or flattening out the piles not only results in segregation of fine material thus hindering proper penetration of the asphalt at spots, but also makes it impossible to uniformly compact the wearing course.

After being spread uniformly over the foundation to the desired thickness, usually about 3 inches loose, the broken stone should be dry rolled until the fragments have firmly interlocked. A ten to twelve ton three-wheel roller is usually satisfactory for this purpose and should be operated exactly as in macadam construction. The extent of rolling is a most important consideration and should be carefully watched. If the stone is not thoroughly keyed together before the asphalt cement is applied it is practically impossible to properly consolidate the pavement for heavy traffic after the pavement has chilled or set. The result will be a wearing course which will develop waves and ruts in the course of time. On the other hand, if the broken stone is over rolled, dust begins to accumulate on the surface of the fragments and tends to prevent proper adhesion of the asphalt. There is also danger of filling the voids with fine material produced by crushing the larger fragments under the roller and thus preventing uniform penetration of the asphalt.

Manipulation of the Asphalt Cement

The first application of hot asphalt cement should be made as soon as possible after the coarse broken stone has been compacted. No asphalt should be applied unless the entire depth of coarse stone is thoroughly dry and after a rain sufficient time should be allowed for drying out. The broken stone surface should be clean and uniform in texture and should be free from all ruts, bumps or depressions.

Before application, the asphalt cement should be heated to a temperaturs between 275 and 350 degrees F, which will render it sufficiently fluid to penetrate the wearing course before congealing provided the weather is not cold. If heated above 350 degrees F. for an appreciable length of time the asphalt will harden and may be otherwise injured by coking or burning. If heated lower than 275 degrees F. proper penetration will be hindered or prevented and an excess will remain near the surface and cause bleeding in hot weather. Application of the asphalt should not be made in cold weather and the air temperature at time of application should preferably be not less than 65 degrees F.

The proper normal consistency of asphalt cement will vary somewhat with climatic and traffic conditions, also with the kind of rock which is used. Because of the relative ease of application in cool weather a strong tendency exists to use a softer asphalt than is altogether desirable. Such practice is apt to produce a wavy road under concentrated motor traffic. In the asphalt macadam, resistance to downward displacement of the fragments of broken stone is mainly dependent upon their interlocking while the bond produced by the asphalt cement creates sufficient resistance to prevent upward displacement and consequent ravelling. Horizontal displacement or shoving is prevented mainly by frictional resistance and the use of a very soft asphalt cement materially reduces such resistance. The same effect is produced by the use of an excessive amount of asphalt.

Uniformity in rate of application of the asphalt cement and its depth of penetration into the pavement are equally important and should receive just as close attention as the proper proportioning and thorough combination of concrete. Proper and uniform distribution can only be secured by the use of suitable methods.

Hand Pouring

In spite of the general impression to the contrary excellent results may be obtained by applying the asphalt with hand pouring pots. It is necessary however that the pots be properly designed and that at all times the spouts be kept open for their full width. Two types of pots should be used, one with a slotted spout not less than eight inches wide and the other with a one-half inch nozzle. In the former, the slot should be horizontal so that the operator walking directly across the road may carry it in one hand and apply the asphalt for a full width of eight inches. The pot with small nozzle should be used only to touch up spots or narrow strips that may be occasionally missed with the wider spout. Great care should be taken that there is no overlapping but that each strip poured makes a neat joint with the preceding strip.

It is not ordinarily advisable to pour the strips at right angles to the centre line of the road as such practice repeated with the seal coat is more apt to develop a washboardy appearance in the finished road after it has been subjected to traffic. A better method is to pour the asphalt diagonally across the road and, when seal coating, to cross the pouring lines of the first application.

As an aid to uniform distribution, alternating the direction of pouring on each succeeding trip is desirable. Before pouring, the pot should be gauged so that during application it will be emptied on one or two trips across the road. Thus a three gallon charge will cover a width 8 inches wide and 25 feet long if applied at the rate of a little over 1.6 gallons per square yard. If the road is say twenty feet wide the angle of application for a three gallon charge is ascertained by measuring off 25 feet diagonally across the road, from side to side. A constant check should be kept on distances and until the pourer becomes experienced a string should be stretched to guide each trip. With a little practice the pourer will soon learn to keep the rate of distribution uniform by walking somewhat faster when the pot is full than when it is nearly emptied.

Mechanical Distribution

Excellent results may be obtained with mechanical distributors provided they are properly designed and operated. Their general features of importance have been well covered in specifications adopted in 1917 by the American Society for Municipal Improvements, as follows:

"The pressure distributor employed shall be so designed and operated as to distribute the bituminous materials specified uniformly under a pressure of not less than 20 lb. nor more than 75 lb. per sq. in. in the amount and between the limits of temperature specified. It shall be supplied with an accurate stationary thermometer in the tank containing the bituminous material and with an accurate pressure gauge so located as to be easily observed by the engineer while walking beside the distributor. It shall be so operated that, at the termination of each run the bituminous material will be at once shut off. It shall be so designed that the normal width of application shall be not less than 6 ft. and so that it will be possible on either side of the machine to apply widths of not more than 2 ft. The distributor shall be provided with wheels having tires, each of which shall not be less than 18 in. in width, the allowed maximum pressure per sq. in. of tire being dependent upon the following relationship between the aforesaid pressure and the diameter of the wheel: For a 2 ft. diameter wheel, 250 lb. shall be the maximum pressure per lineal in. of width of tire per wheel, an additional pressure of 20 lb. per in. being allowed for additional 3 in. in diameter."

In operating a mechanical distributor it is very important that applications should not overlap at either the sides or ends and that at the completion of an application the pipes and nozzle should not be allowed to drain onto the road and thus produce fat spots. In some cases it may be helpful to place strips of building paper along the ends and inner edge of a proposed application to prevent overlapping of the asphalt during passage of the distributor.

It should be remembered that the covering capacity of a large mechanical distributor is greater than the rolling capacity of a single roller and the natural desire to use a distributor to its maximum capacity should not be allowed to handicap the construction of the road through under-rolling.

Filling Surface Voids

Immediately after the first application of asphalt has been made, and progressing with it, a thin uniform layer of small size broken stone should be spread over the surface in such quantity as to fill the surface voids. The road should then be rolled with the addition of more broken stone if necessary until the surface is tight and thoroughly bonded.

It should be broadcasted with a wide side swing of the shovel in order to distribute it uniformly in a very thin layer. The use of an excessive amount is not only wasteful but will result in caking on the surface and in the formation of an excessive amount of stone dust under the roller. After the road has been thoroughly rolled it should be carefully broomed to clean the surface and remove all fine material which is not firmly held in place by the asphalt. The road is then ready for the application of the seal coat.

Application of Seal Coat and Cover

The second application or seal coat of asphalt is made in exactly the same manner as described for the first application except that the quantity is less. From 0.5 to 0.75 gallon per square yard will ordinarily be required. The same grade of asphalt should be used as in the first application.

Immediately after the asphalt is applied it should be covered with a uniform layer of small size broken stone such as used after the first application. The road should then be rolled until the surface is smooth and uniform. In general the amount of cover should be kept to the minimum required to blot up the excess asphalt and prevent it from sticking to the wheels of the vehicles. The mat so produced should not exceed a thickness of ½ inch and should preferably be about ⅜ inch. The broken stone should be broadcasted over the road so as to make the cover as thin as possible and as rolling progresses additional stone should be spread where its need is indicated.

Maintenance

Ordinarily maintenance of a properly designed and properly constructed asphalt macadam pavement will consist only in the rejuvenation of the seal coat or mat or its renewal as it is worn away. Unless traffic is exceedingly heavy or a large amount of dirt has been brought onto the road and ground into the surface no treatment should be necessary for a period of about 5 years. A very light cold surface treatment with road oil at the rate of from 0.2 to 0.25 gallon per square yard, followed by a light cover of stone chips will serve to rejuvenate an old seal coat which has not worn badly or become broken. The use of an excess of such oil should be carefully avoided first because it may soften the underlying asphalt to too great an extent and second because the cover required to blot it up will create too thick a mat which is likely to shove under traffic. In no case should the total thickness of the old seal coat and new material exceed ½ inch.

Such renewal may be made by surface treatment with a cut-back asphalt or a very heavy grade of road oil after the road has been carefully swept to remove dust and all loose material. The same general method should be used and the same precautions observed as in the application of the original seal coat.

If for any reason breaks or scaling should occur in the seal coat it should be promptly repaired by thoroughly brooming and cleaning all such weak spots. Cut-back asphalt or a very heavy grade of road oil may be hand poured over the exposed surface at a rate not to exceed 0.5 gallon per square yard. Cover should then be applied in sufficient quality to blot up all excess and bring the patches flush with the surrounding area after rolling or tamping. An excellent method is also to spread and compact a mixture of stone chips and emulsified asphalt over the broken areas.

By maintaining the seal coat, breaks or disintegration of the pavement proper will be prevented and the life of the pavement continued indefinitely. If, however, through faulty design or construction breaks occur, they should be promptly repaired. When possible the cause of such breaks should first be ascertained in order to apply the proper remedy.

Bumps may sometimes be remedied by cutting them off with a hot shovel but in general patches should be made for both bumps and depressions in the pavement proper. This may be done by cutting out the defective areas so as to produce excavations with approximately vertical sides for the entire thickness of top course. The excavations should then be thoroughly cleaned after which they are filled either with broken stone of the same size and quality as used in original construction or with an asphaltic concrete. If the first method is used the stone should be firmly interlocked by tamping after which melted asphalt is hand poured and the patch finished as described for the original construction of the pavement, seal coat also being applied. In the second case unless facilities are readily available for the use of a hot-mix it will be found convenient to patch with a mixture of broken stone and emulsified asphalt.

Emulsified asphalt patching mixtures are usually prepared on a mixing-board or platform but sometimes an ordinary concrete batch mixer is used. The mix is proportioned by volume, the proper amount of asphalt being dependent upon the character and grading of the mineral aggregate.

After the mix has been prepared it should be laid in the clean hole and tamped or rolled flush with the surrounding area. The patch should then be sanded or covered with a light dressing of stone chips, after which it should be allowed to set up for a short while before being subjected to traffic.

For patching shallow ruts and depressions a mixture of emulsified asphalt and small size broken stone is sometimes used without first cutting out a hole. Care should be exercised, if this method is followed, that the old surface is first very thoroughly cleaned. While somewhat more costly it is safer to cut out the old surface as concentrated traffic is apt to squeeze the patching mixture out of a depression with cup shaped or rounded sides. If the maintenance of an old asphalt macadam pavement has been neglected to the extent that it is so badly broken up or out of shape as to need resurfacing it should either be removed or scarified and reshaped to form a foundation for a new pavement.

Sliding Forms for Concrete Construction

System of Building Monolithic Walls by Moving Forms Continually Upwards as Concrete is Placed

THE term "sliding forms" is used to designate that system of building monolithic concrete walls wherein the forms are moved continually upward as concrete is placed. Such forms include not only the forms proper, between which the concrete is placed, but the apparatus necessary to lift them. The forms proper are usually of wood and in general consist of inner and outer sections, 4 feet high, held apart the thickness of the wall by yokes. The yokes are supported and lifted by means of jacks which in turn derive their support from vertical rods or pipes embedded in the concrete.

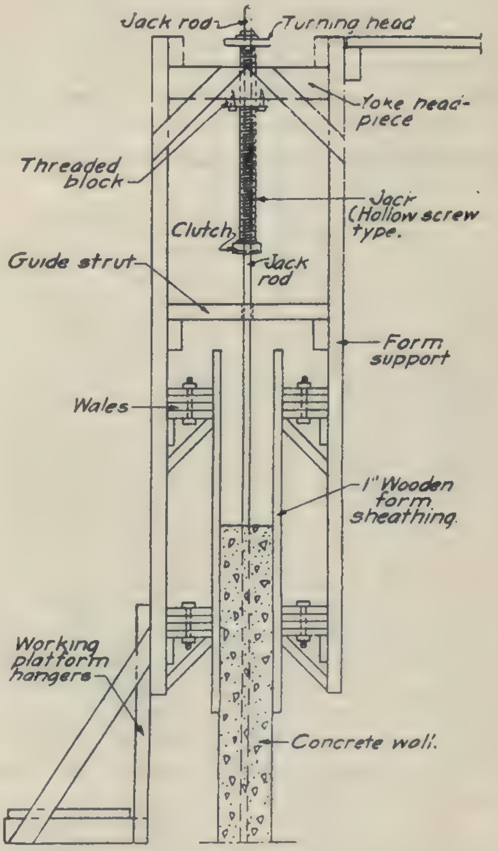
An accompanying diagram illustrates the usual arrangement and principle of sliding forms. The main objects to be attained are to produce a truly monolithic structure, that is, one without construction seams, and to effect economy of form material. Obviously this requires continuous placing of concrete 24 hours daily. In the operation of raising the forms it is essential that they be moved upward at a steady and uniform rate. so that the concrete will not adhere to them and thus be carried with the forms when they are jacked up. It is essential to producing walls truly vertical and of the same thickness at all points that the forms be kept in exact horizontal and vertical relation to each other. These requirements indicate that although the system is quite simple, experience and constant watchfulness are necessary to obtain the best results. It is also evident that the system of jacking up forms must permit of positive control on the part of the operator and that no slipping of the jack on its support shall take place.

Construction of Forms

The forms are usually made up of an upper and lower wale, consisting of 2-inch planks with broken butt joints. In circular concrete construction, one edge of these planks is cut to a radius of the wall surface plus or minus the thickness of the sheathing. Thus there is an inside and an outside pair of wales cut to segments proper for the curve of the outside and inside of the wall, respectively. To these built up wales, 1-inch sheathing about 4 feet long is nailed, usually with triangular bracing between the wales to give the forms required rigidity. The yokes are attached at intervals to these forms and may be entirely of wood, although the head piece is often made of steel plates so as to insure little variation in the separation of forms and to give a rigid yoke member to take the lifting action of the jacks.

Jacks for Lifting Forms

Jacks used are of several different types, some of which are patented. Two types are common. Both of these work on the jackscrew principle. A common type of jack consists of a hollow screw fitted at its top with a turning head and at its bottom with a device commonly known as a clutch, or "dogs," for



Sketch illustrating essential features of sliding forms for concrete construction gripping a vertical jack rod which is embedded in the concrete. The jack rod passes up through the centre of the jack, which, in turn, passes through the threaded head piece of the yoke. By turning the turning head with a bar, the yoke is caused to move up, taking the forms with it. Successive turnings of the jacks through the same angle will thus cause every portion of the forms to move the same distance. A strict regulation of the amount of turning which each turning head is given is absolutely necessary to correct operation of the forms.

Another type of jack consists of a threaded rod fitted with a collar which bears on a 1¼-inch pipe embedded in the concrete. The threaded rod passes through the head piece of the yoke and is fitted with a turning head. The pipe is made in 3-foot lengths, cut square at the ends and without threads. The lower end of the threaded jack rod extends down through the 30-foot length of pipe and 6 inches into the pipe below. This keeps all of the 3-foot lengths of pipe in line, while the collar bearing on the top of the uppermost pipe furnishes a positive support to the jack. When the forms have been raised the full distance of their travel for one position of the jacks, the clutch is released, the jack moved up and a short length of rod or pipe, as the case may be, placed on top of and in line with those already embedded in the wall. The clutch then engages the rod and the work proceeds. When rods are used, the successive short lengths are connected by sleeves.

Sliding forms have been used for a considerable variety of structures. These include standpipes, water tanks, grain tanks, grain elevators, mills and chimneys. They are also adapted to the construction of hollow concrete piers and warehouse walls, although so far but little used in such construction. When such forms are used by experienced contractors on the latter class of structures, window openings can easily be provided for and cross beams from one wall to another be built without special difficulty.

Methods of Repairing Timber Bridges

Practice of Railways in Replacing Pile Bents and Renewing Timbers, Stringers and Ties—Gang and Material Distribution

At the recent annual convention of the American Railway Bridge and Building Association a resume of the present practice of railways in repairing timber bridges was given in a committee report last month. An abstract of this report is given herewith:

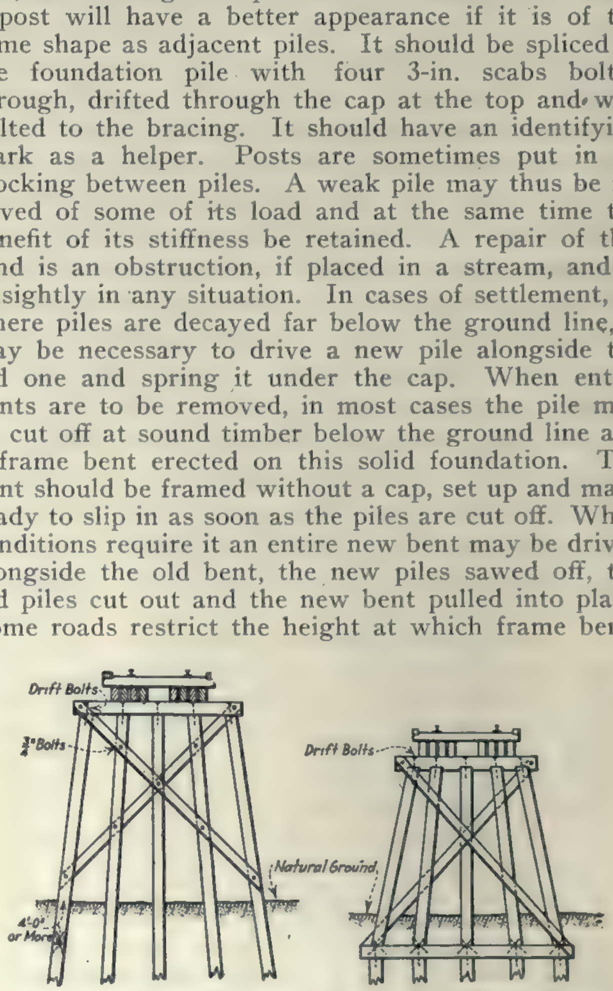
Gang and Material Distribution in Repairing Timber Bridges

In general, gangs for timber bridge work consist of a foreman, an assistant foreman and 6 or 8 men, as follows: Two first-class carpenters, two assistant carpenters and two to four laborers. Variations from the above are made as the work demands or in accordance with the kind of men available.

The distribution of material depends on the quantity to be handled and traffic conditions. Where material is ordered from the mill, cars may be consigned to the station nearest the bridge site for unloading or redistribution by one of the methods mentioned below. When shipped from the storehouse, the use of company service cars may be found convenient. These can be held under load and shipped from point to point as the work progresses. For unloading use may be made of a special work train or, where the quantity of material does not justify this expense, recourse may be had to a local freight train. When two or more cars are to be unloaded it may sometimes be found economical to distribute the unloading by local freight train over several days. Small quantities are handled by motor trailer or push car.

There does not seem to be uniformity of practice in the use of second-hand material in any given part of the bridge. It would appear to be the best policy to use second-hand material only for blocking and helpers on important lines, but it might be used somewhat more generally on light traffic lines in bridges, the life of which will not be greater than the life of the material.

Where one-third or less of the piles in a bent are in bad shape satisfactory repairs can usually be made by cutting off in solid material at or below the ground line, and setting in a post on this foundation. Such a post will have a better appearance if it is of the same shape as adjacent piles. It should be spliced to the foundation pile with four 3-in. scabs bolted through, drifted through the cap at the top and well bolted to the bracing. It should have an identifying mark as a helper. Posts are sometimes put in on blocking between piles. A weak pile may thus be relieved of some of its load and at the same time the benefit of its stiffness be retained. A repair of this kind is an obstruction, if placed in a stream, and is unsightly in any situation. In cases of settlement, or where piles are decayed far below the ground line, it may be necessary to drive a new pile alongside the old one and spring it under the cap. When entire bents are to be removed, in most cases the pile may be cut off at sound timber below the ground line and a frame bent erected on this solid foundation. The bent should be framed without a cap, set up and made ready to slip in as soon as the piles are cut off. When conditions require it an entire new bent may be driven alongside the old bent, the new piles sawed off, the old piles cut out and the new bent pulled into place. Some roads restrict the height at which frame bents



Method of Replacing Portion of Pile Bent by Frame Bent.

shall be used in this manner to 10 ft. In renewing caps it is first necessary to pull the stringer bolts to clear the cap. Then jack up the deck 1 or 2 in. (jacks may be supported on the ground or on sash timbers bolted to the piles for the purpose), raise the old cap to give room to cut off the drift bolts with a hack saw. When this is done, roll off the cap. The new cap having previously been framed and a hand line attached about its center, let it down over the side of the deck and swing it into place. Drift it to the piles, lower the deck and redrive the stringer drift bolts. When a scaffold is necessary for this work it may be hung from the ties with staging hooks carried regularly in the outfit for this purpose. An old cap may also be removed readily by cutting it into three or four pieces and splitting it out. This gives easy access to the drift bolts in the tops of the piles.

Renewing Stringers, Ties, Etc.

The renewal of an outside stringer is quite simple, as it is only necessary to withdraw the bolts, jack up the rail and ties about 2 in., turn down the stringer to be removed, shove it out on the caps, drop the new stringer previously framed on the caps and raise it up and bolt it. To renew the middle stringer in a chord the method is similar but with broken joints it is necessary to remove the bolts extending over four panels. After raising the track, the two outside stringers are laid down, the weak center stringer removed, the new one placed and the balance of the chord reassembled. When it is necessary to renew an inside stringer, it may be done in single panel lengths from the inside as described above, the new stringer being handled with lines through the deck. In renewing an inside stringer extending over two panels, it is necessary to take up the guard rail and shift the ties, either along the track or to one side. It is then possible to drop the new stringer vertically into place. This method may also be followed with center stringers. Some prefer to raise the track a little more than the width of the stringer, roll the old stringer over to its side and raise and work it over the chord and on to the caps. The new stringer is placed by reversing this operation.

A method of strengthening the chord involving much less labor consists in adding an additional stringer on either side of the existing chord. It is not, however, good practice to leave partly decayed timber in a bridge because of the fire risk.

Isolated Ties

In renewing isolated ties, remove the adjacent deck bolts and pick up the track about 6 in. Place a 4-in. stick about 10 ft. long across the stringers on each side of the tie. These may be held in place by wedging under the rail or other means and should project on the side toward which the tie is to be moved. Rollers are slipped under the tie and it is rolled out until it clears the rail, when it can be lifted up on to the track and disposed of. Where a number of ties are to be renewed, put in all the new ties in one place and spot in the good second-hand ties where needed. In such cases it is usually necessary to take up the guard timbers where the new ties are put in. Another method is to raise one rail higher than the other, slip the ties out to clear the low rail and then back and over the low rail.

It is usual to lay guard timbers in position and mark the location of the ties. The daps are then cut in them, either on the bridge or the bank, and the timber placed in final position. It is the practice of one road reporting to this committee, where more than 50 ft. of guard timber is to be replaced, to measure the tie spacing on the bridge and dap the timbers in the shop.

Method of Renewing Bridge Timbers

The year's program for timber bridge work having been determined, it is usual to do all the driving in advance and let the pile driver crew return later to place the timber, or have this work handled by other crews. A minimum of pile driver and work train service is thus secured. After locating the bents to the best advantage relative to the waterway and clear of existing bents, and marking their location on the rail, the guard timbers are taken up, the ties are shifted to clear the new bents and driving is started. It is usual to work backward on a bridge. The work will proceed more rapidly if piles are distributed on the ground in advance. After driving the piles, the ties are re-spaced as well as is possible and guard timbers are relaid, cutting out the spacers where necessary.

When the bridge crew arrives at a bridge where the piles have been driven as above, the first step is to straighten and line up the tiles. This may be done with jacks and steamboat ratchets and the piles should be held in position. If badly out of line, this work should be done with the pile driver before it is moved from the job. After marking the grade, usually obtainable from the track, and attaching a guide board the piles are cut off. The stringers and deck are then raised about 2 in. on the old caps to permit the placing of new caps. The cap is brought in, swung off the deck on to the top of the piles and drifted in place. Sway bracing is next put on and bolted up. With high bents, say over 20 ft., some longitudinal bracing should be put on as the stringers are placed.

As soon as two or more caps are in place measurements for the length of the stringers are obtained and the framing of stringers can be started. This should be done on a level stretch of ground as near the bridge as possible and consists in cutting to length, sizing to depth over the caps, and boring for drift bolts where they are used. Holes may also be bored through one line of stringers in each chord for packing bolts.

Methods of assembling stringers into chords are varied. In most cases one chord is changed out completely before the other one is disturbed.

Changing Old Ties

In renewing a bridge, when the old ties are in bad shape about one-half the new ties are put in between the old ones before placing the stringers. This gives a more substantial deck to work from. The remainder of the new ties are put on after the stringers are changed. Ordinarily ties are put in between the old ties or in groups as traffic permits, after the new stringers are in. Some roads defer this work until all the heavy timber released is picked up to avoid scarring up the new deck.

Every bridge gang should have a sufficient supply of the ordinary tools of good quality. Where special tools have been tried out and proven advantageous, gangs should be supplied with them. There can be no argument about the desirability of labor-saving devices at the present time, not only as a means for reducing the amount of labor but for keeping the men employed better satisfied.

Paving Brick Manufacturers Propose Lugless Brick, Standard Sand Cushion for Bituminous Fillers and Four-Inch Base

THE National Paving Brick Manufacturers' Association has adopted new specifications for standard vitrified paving brick that contain two new features. The first is that the brick "shall be wire-cut and shall have square edges," and the second provides for a reduction from the standard 3½ x 4 x 8½-in. brick to 3 x 4 x 8½ in. While the language of the specifications with reference to the kind of brick specifies that they "shall be wire-cut and shall have square edges," the association explains that its intent is a standard plain—that is, a lugless, brick.

In the specifications covering the laying of pavements, the association recommends that sand cushions be made standard for bituminous fillers, a cement-sand bed, however, being retained for use with cement fillers. Recommendation is also made that the minimum depth of concrete base be reduced from 6 to 4 in.

These four recommendations, two relating to the brick itself, one to the type of cushion, and the fourth to the base, were presented by the association to the Brick Committee of the American Society for Municipal Improvements at its New Orleans convention Nov. 13. The proposed specifications, however, were not acted upon by the committee or, at least, were not reported out to the floor of the convention.

In presenting the matter to the American Society of Municipal Improvements, the association gave the following reasons for the recommended change:

"1. Economy in manufacturing costs by eliminating higher cost incident to producing many varieties of the same article.

"2. Insuring the production of the highest possible percentage of No. 1 brick, uniformly and thoroughly vitrified beyond all service requirements.

"3. Convenience, by affording a uniform brick available from any and all manufacturers.

"4. Providing a larger possible measure of economy in brick pavement construction by reducing the weight of brick per square yard approximately 25 per cent., when laid flat."

Need for standardization is due, says the association, to the following facts:

"The paving-brick industry is now producing more than 12 different styles of brick for street and highway surfaces.

"The capacity of the industry is approximately 3,250,000 tons annually. Coal consumption amounts in round numbers to 6,000,000 tons in a year.

"Even a comparatively slight relative economy applied to these figures means much in absolute value. The need for utmost economy, as measured by the lowest possible production costs, is vital as a national service. This applies to all industries, paving brick included."

Added service value can be secured, says the association, because "careful grading of product to meet the standards of quality for street surfaces leaves off grade material," inasmuch "as the percentage of off-grade material is reduced by a larger proportion of No. 1, manufacturing costs are lowered."

Added reasons for the proposition of changes in specifications are, says the association. that the "size and character of standard brick we propose to the society is the one that lends itself to uniformity in structure and vitrification with minimum weight. While standardization of product is conceded to be essential, it naturally should not be accomplished at the cost of loss in service value, It should, and in this instance will, bring added service value.

"The convenience to buyers of being able to secure the same size and character of product from any manufacturer is evident on the face of it.

"Reduction in weight per square yard wherever transportation and handling are involved is a readily recognized advantage in aiding more economical construction."

Continuing, the association proposes "that it clearly be stated in the specifications of the society that sand is preferred as a cushion material, jointly with granulated slag and stone screenings (as representative of the same type of cushion) when bituminous fillers are used.

"This recommendation is in effect a positive statement that would define the usefulness of sand as a cushion material, lest the fact that general usage of the sand cushion and cement grout filler has been abandoned be construed as discriminating against sand cushions.

"It opens the door to the next logical recommendation, that a specification be admitted for the cement-sand bed to accompany the use of cement filler.

"The amendments are proposed in accord with general practice now prevailing in all sections of the country.

"The proposed reduction in the minimum depth of concrete base for brick pavements is made, believing that it is the desire of the society to place its specifications at the services of engineers in all communities, large and small.

"Without question, there are streets in cities that logically require bases as deep as 6 in. when concrete is used.

"But there are many more conditions where 4 in. is quite sufficient for all requirements. Using 6 in. would then be an extravagance.

Must we not think in terms of the combined subgrade and artificial foundations? May we not say that first attention should be paid to secure a thoroughly well drained and stable subsoil ?

"With that assured, the function of the base is more to distribute loads than to support loads.

"If for no other reason, the fact that 4-in. bases are now and have been for many years in actual service, without the slightest question as to adequacy, would supply all the evidence needed in support of this recommendation. After all, we are merely speaking of minimum depth."

Mr. John J. Downey, buildng contractor, of 398 Sunnyside Avenue, Toronto, died recently from pneumonia after an illness of about a week. The late Mr. Downey was born in Dixie, Ont., coming to Toronto in 1901, and from that time until shortly before his death had been engaged in the construction business here.

The annual conference of the Association of Canadian Building and Construction Industries will be held January 27 to 30 at the Chateau Laurier, Ottawa.

Comfortable Homes for Workmen

THE accompanying sketches show a type of seven-roomed house that the Westinghouse Electric & Manufacturing Company are building for their employees in East Pittsburgh, Pa. At present forty-eight houses are under construction, but that number will likely be increased.

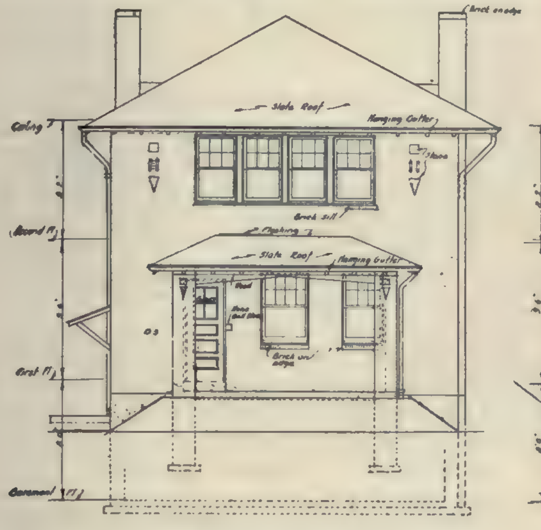
In designing these homes an effort has been made to do away with features that have outlived their usefulness. The parlor and centre hall, so common in many houses, are missing, and in their stead is found a large, comfortable living room with a large fireplace. Eliminating the centre hall effects a considerable saving in space.

The dining room, which adjoins the kitchen, is provided with a large china closet, while in the kitchen a built-in sink and cupboard is included. Having the kitchen and dining room adjoining lessens the number of steps and aids materially in decreasing the labor of housekeeping.

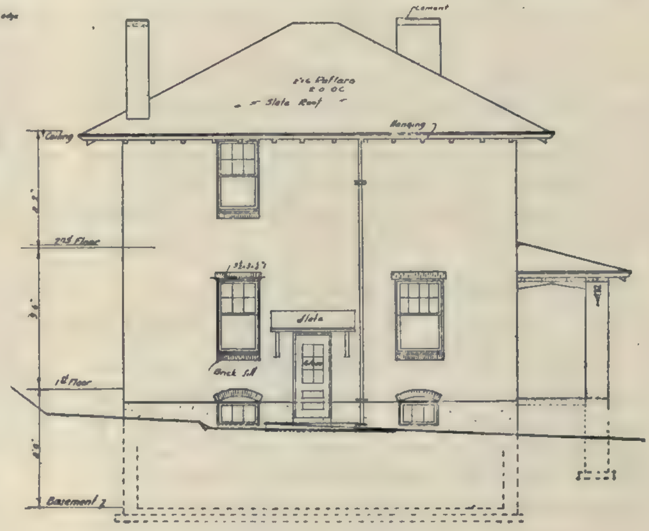
A grade entrance is provided at the side, which while serving the kitchen, gives admittance to the basement, and enables ashes, etc., to be removed from the cellar without having to carry them through the kitchen.

On the second floor four bedrooms are arranged, each with a roomy clothes closet. A commodious linen closet for bed clothes, etc., is constructed off the hall.

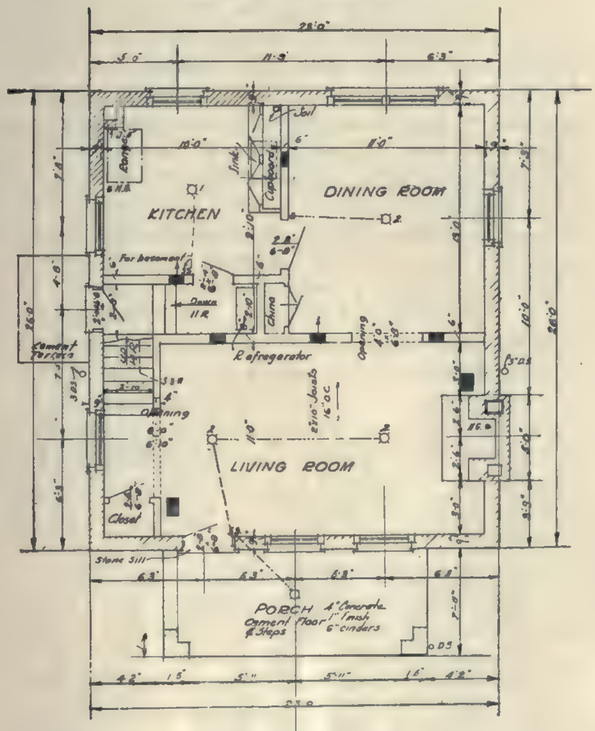
It may be of interest to know that the Westinghouse Company is one of the pioneers in building houses for its employees, having constructed a number of homes for their workmen ten years ago. In addition they own a large number of apartment houses. T. P. Gaylord, vice-president of the company, is in charge of the building programme.



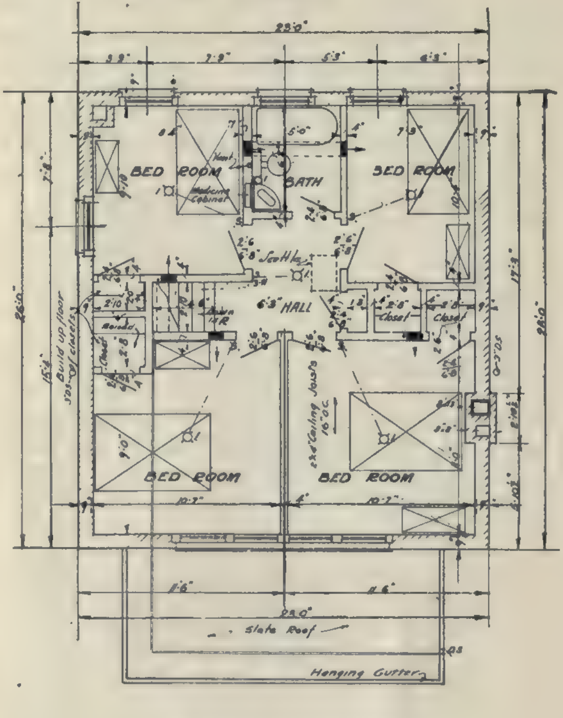
FRONT ELEVATION



LEFT SIDE ELEVATION



FIRST FLOOR PLAN



SECOND FLOOR PLAN

Organized Accident Prevention*

Of all the questions that arise between employer and employee there is none perhaps in which we find such common ground and such good understanding as in the matter of compensation for injury. It is true that there were a number of companies in Ontario who, before the Compensation Act was put into force, did not fully appreciate the importance of compensation, but there were many who did. I well remember sitting round the council table of the Manufacturers' Association with a group of manufacturer at the time the Compensation Act was first under consideration, and am able to say that the Act as finally adopted is very similar to the skeleton act which was worked out by the employers at that time. There were, of course, a number of contentious features when it came to the working out of the detail of the Act, but in principle there was unanimity of feeling from the beginning between the employer and employees who were making representations before the Commission on this subject.

If what I am going to say is to be effective, then I must be practical and, to make it so, I must deal with concrete cases within my own knowledge, so you will have to excuse me if I refer more or less to the company I represent in speaking on this subject. I was asked to speak on the prevention of accidents from the manufacturers' standpoint.

Worker Entitled to Compensation

Long before there was a Compensation Act our company recognized the fact that the worker was entitled to compensation for injuries, and that, whatever the expense, it was just as legitimate a part of the cost of our goods as the wages we paid. For twenty years before the Compensation Act came into force we never had a compensation dispute with one of our employees, for the simple reason that our treatment was very much more generous than the treatment under the Compensation Act. Throughout that entire period we paid full wages to any man injured for the time he was off, which is very considerably more than the Act allows. If a person were killed we always paid $2,500 to his dependents, without any question. That I do not consider as safe as the system in force under the Compensation Act of paying an annuity. We also paid the hospital and doctor's expenses. We did not feel in doing this that we were doing any more than we were justly entitled to do. We also felt that it was worth while from a human standpoint, because we wanted to get the men back as quickly as possible into their places. We were able to do all this without undue burden, because we had no expense in connection with litigation. As a matter of fact, our compensation through the Compensation Board was very much higher than our payments under the old system. Of course, that is accounted for to some extent by the new conditions and the fact that we had a number of new hands in our factory. If you have people coming and going frequently you are sure to have more accidents than you would have with experienced workmen. We have found that no matter what you do in the matter of safety appliances, it is very difficult to get them used in the way you intended. For years we have periodically brought in Safety experts to go through our various shops and to criticize what we had and to suggest new appliances. We have permanent committees in each factory, called "Safety First Committees," whose duty it is to make a survey of the situation from time to time and try and keep the appliances up to date.

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*Extract of address before the Ontario Safety League by Thomas Findley, president and general manager of the Massey-Harris Co., Ltd.

Secretary of A.C.B.C.I. Reports Optimism Among Builders in the West

The acting secretary of the Association of Canadian Building and Construction Industries, Mr. J. C. Reilly, has just returned from a trip across the western part of Canada. He reports a general feeling of optimism among the builders in the various cities visited regarding the opportunities for the coming year. Even in the districts which suffered heavily from the drought there seems to be considerable building in prospect. Everywhere the feeling was expressed that if materials in sufficient quantities and at the right prices could be obtained and the labor situation cleared up that the coming season should be a banner one.

While in Winnipeg, as reported in our last week's issue, Mr. Reilly was the guest of the Exchange at their annual banquet, some 160 being present. He also addressed the Exchanges in Regina, Saskatoon and Moose Jaw, and visited the builders in Vancouver and Victoria. In Calgary a new Builders' Association has been formed and is doing splendid work; and in Edmonton, an association is just being organized.

The Annual Conference of the Association is to be held at the Chateau Laurier, Ottawa, January 27th to the 30th, and it is anticipated that a strong Western delegation will be present.

Proposal to Group Engineering Departments of St. John, N.B., Under One Head

A proposal that the several divisions of the engineering department be brought under one head is being considered by the city council of St. John, N. B. The object is to effect increased co-operation and to achieve a greater degree of efficiency. It is proposed to have all the engineers in the city service located in the same building where they would have ready access to the drafting room and the laboratory. In addition, it would then be possible for the engineer who was not very busy to help out his colleague who was laboring under a heavy pressure of work. This would tend to relieve undue strain and would serve to give the men of one division a general knowledge of the working of other divisions.

How Maj.-Gen. Loomis Won Honors

In the London Gazette particulars are given of the services for which Major-General F. O. W. Loomis, of D. S. Loomis & Sons, general contractors, Montreal, was awarded a bar to the D. S. O. The bar was given for "great gallantry and brilliant leadership during the operations southeast of Amiens. He made reconnaissances under heavy fire. personally superintending the disposition of troops and encouraging all by his coolness and ability. The results achieved by the brigade were of an outstanding nature."

Hints for the Contractor

That May Save Him Time and Money—We Will Pay for All Accepted Items—Send One In

Economical Equipment Keeps Aggregates Clean on Road Job

LABOR conditions this season have made it necessary for the highway contractor to employ as many labor-saving devices as possible. While the equipment described in this article from Concrete Highway Magazine might be improved upon in some details, it nevertheless is an example of what any contractor may accomplish without incurring much expense for his outfit.

On a contract on the Transit Road, Erie County, N. Y., known as Repair Contract 1199, two miles of old water-bound macadam are being resurfaced with 6 inches of reinforced concrete. The contractors, Wing & Munger, of Holley, N. Y., devised a time-saving method of handling aggregates on this work. Time-saving was important because the road is the main route between Buffalo and Lockport, making it imperative that the road be closed no longer than absolutely necessary.

A bin was built at the railroad siding so that a motor truck with flat top body carrying ten material boxes could pass under the bin. These boxes were made of 2-inch material and were 2 feet square, inside measurement, and 2 feet 6 inches deep. With allowance for the space occupied by 2 by 4-inch uprights at each corner, the boxes held exactly the correct amount of material for a batch of concrete. A horizontal bar of iron passed through each box and projected 4 inches on each side. This bar was slightly above the center of gravity, making it easy to tip the box and empty the aggregates into the mixer skip. Ten of these boxes, five to a row, made a truck load.

When being loaded at the bin, each box on one side received its quota of sand, and at the other end of the bin, its quota of crushed stone from the small tiers or grates at the bottom of the hopper. The truck then turned around and passed under the bin again to permit filling the boxes in the other row. Although one man could handle the filling of the boxes, it proved easier to have a second man watch the quantities which went into each box and signal the operator when to stop.

A small derrick with 4 by 4-inch mast and boom built up with 2 by 6-inch material was fixed to the mixer so as not to interfere with its mechanism. A ½-inch cable was used, at the end of which there was hung a bridle that fitted over the ends of the iron rods in the box. The cable was so adjusted to the winch on the mixer that as the skip was lowered to the ground, its weight was sufficient to raise the material box about 15 inches above the truck. Since the mixer was kept on one side of the grade and the truck with the material box on the other, the tilt of the mixer, due to the crown of the road, was enough to swing the material box around over the skip by gravity. The men at the skip then tipped the box and while they added the cement, a "tag line" operated from the truck pulled the empty box back. As the skip was lifted, the box was lowered into place and the bridle attached to the next one. One man on the truck handled the bridle and broom very easily.

At the mixer the operator, a fireman, two men to handle the material boxes, three to spread the concrete and two to do the finishing made a crew sufficient to produce an average of 300 feet of 16-foot pavement per day.

An improvement on the foregoing outfit might be made by using a platform alongside the mixer the same height as the truck, equipped with rollers. The truck bed also should have rollers. This platform could be moved with the road roller as often as the mixer moved ahead. Fewer trucks might then be used and the boxes rolled onto the platform, permitting one truck to make more trips per day.

The equipment, as described, has proved satisfactory both from an economical standpoint and from the fact that no foreign matter could get into the aggregates.

Dredge Scows to be Emptied Let Down Niagara River on Lines

DREDGED excavation from the bed of the Welland River, which forms the first stretch of the new Queenstown-Chippawa power canal around Niagara Falls being built by the Ontario Hydro-electric Power Commission is being dumped from scows in the Niagara River about a mile and a half above the brink of the Canadian falls. As the current is very swift here, and the danger of a scow getting away is great, the scows are let down the river from a fixed crib in the Niagara River just off the mouth of the Welland River. This consists of a pile crib, and attached to it is a scow carrying hauling machinery; that is, an ordinary hoisting engine with about 2500 ft. of line. The operations are described in Engineering News-Record as follows:

The scows are brought by the tugs to the crib and attached there to the hoisting line. They are then let down the river with an attending tug, or sometimes two, which, for the first thousand feet, act merely as guides. After that length of line is paid out, it commences to drag on the bottom and the tug has to exert some slight pull on the filled scow. At the end of the 2500 feet of line the scow is dumped, and is then hauled back by the line to the fixed hoist, where the tug picks it up and takes it back up the river to the dredge.

About a year ago a scow on the other side of the river, with five men aboard, got loose and washed down to the brink of the Canadian falls. Three of the men jumped overboard and were lost. Two of them, however, remained aboard and when the scow caught on a projecting rock almost at the brink of the falls were rescued by a lifeline shot out from the adjoining Ontario power development power house. This ac-

Canada's Contractors—W. E. Dillon

Mr. W. E. Dillon, sheet metal and roofing contractor, Toronto, was born at Port Perry, Ontario County, Ont., in the year 1866, where he lived till he was eighteen years of age. He then went to Orangeville and served his time there during the next three years with Johnson Bros. When he was twenty-one, he came from Orangeville to Toronto and for some time worked with John Douglas, shortly afterwards going into business in partnership with Mr. Tucker, under the firm name of Tucker and Dillon. After eight years this partnership was dissolved, and for the next two years Mr. Dillon was superintendent of contracts for the Metallic Roofing Company. In 1905 he went into business for himself and the following year formed a joint stock company, taking in four of his employees, under the name of W. E. Dillon & Co., Ltd. This firm has done work in connection with a large number of important buildings, including the St. Lawrence Market, Toronto; the Horticultural Building and the Grand Stand at the Canadian National Exhibition Grounds; Central Technical School, Toronto; the Parliament Building, Ottawa; Ontario Government Library Building; General Motors plant at Oshawa; Royal Connaught Hotel, Hamilton; Ontario Government House; General Hospital and Sick Children's Hospital, Toronto; Whitby Asylum; Guelph Prison Farm buildings.

Mr. Dillon has been very active in Builders' Exchange work for the past five years. He was president of the Toronto Builders' Exchange in 1918 and is on the Executive of the Provincial Builders' & Supply Association, as a member of the Legal Committee. He is also a member of the National Council of the Association of Canadian Building and Construction Industries. There are few contractors who work as consistently, or as effectively, as Mr. Dillon, in the interests of the profession.

Mr. W. E. Dillon

cident, however, led the engineers of the Ontario Hydro-electric Power Commission to consider some safe method of controlling the unloaded scows.

When Most Accidents Occur

Some interesting facts in regard to safety work have been gleaned from the Safety Committee's experience in connection with the large plants of the General Electric Company industries on the other side of the line. The tabulated data shows that more accidents occur on Monday than on any other day of the week and that the most careful age is found to be 37. Other striking incidents are that the ages showing most accidents in proportion to the number of employees are between 22 and 26. and 50 years and over. The hour showing most accidents is from 9 to 10 a.m. Fifty per cent. of the accidents occur to new employees or those who have been less than six months in one position. Contrary to general belief, the foreign-born employees are quick in acquiring the safety habit, if taught. More accidents occur in the hot season than in the cold. Over 80 per cent. of the accidents are due to carelessness. The average woman on the same kind of work meets with an accident only one-third as frequently as the average man.

Electrolytic Process of Sewage Disposal

The relatively new electrolytic process for the purification and disposal of sewage is attracting considerable attention and appears to offer many advantages over other systems now in use, and plants now in operation are giving perfect satisfaction. Others are under construction. The fact that the plant can be located anywhere in the city limits without giving offence eliminates the necessity for the installation of long trunk sewers and is an important feature.

Equal Representation on Montreal Builders' Exchange

Following upon the change made in the by-laws, the three sections composing the Montreal Builders' Exchange must meet this month and nominate members for election to the Board of Directors of the Exchange for 1920. These three sections are general contractors, trade contractors and supply dealers. The intention is to give each of the three classes equal representation. The annual meeting of the Exchange will probably be held on February 16.

Baines & David, Ltd., New Name of Old Concern

Baines & David, Limited, iron and steel merchants, Toronto, are carrying on without interruption the business of the firm of Baines & Peckover, which has been dissolved. Baines & David are continuing in the same premises as occupied by the old concern, 98-116 Esplanade East and warehouse at the Eastern Harbor Terminals. Mr R. A. Baines and Mr. W. M. David have both been connected with the steel business nearly all their lives. Mr. Baines founded the business in 1894 and has been with it since. Mr. David has been with the firm since 1906 and for some years has been sales manager. Under the reorganization the firm will continue the same vigorous business policy which it has maintained in the past.

Mainly Constructional

East and West—From Coast to Coast

The electors of Kitchener carried the Hydro by-law by a majority of 767.

The electors of Kitchener defeated a by-law to abolish the Water Commission.

The electors of London, Ont., voted $100,000 on Jan. 1 for a waterworks reservoir.

The ratepayers of Hamilton on New Year's Day passed, by a large majority, the by-law in connection with the Hydro Radial scheme to connect Hamilton with Guelph.

All the by-laws submitted to the electors of Hamilton on New Year's Day were carried, these including: building an overflow sewer; construction of Mountain highways; certain improvements to their parks; construction of an athletic field.

Superintendent Williams of the London Division of the C. P. R. announced recently that it is planned to spend half a million dollars on improvements on Western Ontario lines next summer. An automatic block system for the main line is one of the principal expenditures.

Permit was issued recently to the Canadian Amusement Company, Montreal, for the construction of a 10-storey building on Major street, between St. Alexander and Bleury streets, at a cost of $126,000. The dimensions of the building which will be of cement and brick construction, are 64 ft. x 42 ft.

Waterloo County, Ont., plans to build a concrete road from Galt to Hespeler and to the county line between Guelph and Hespeler as part of the Provincial county highway system, and has asked Wellington County officials to consider the construction of their portion of the road from Guelph to meet it.

The Galt, Ont., ratepayers have passed a by-law to raise $30,000, by debentures, to install a central heating plant on the hospital grounds, to heat the general hospital, isolation and maternity hospitals and nurses' cottage. By a majority of 956, only 73 voting against, Galt also passed the Hydro Radial by-law.

The Guelph Housing Commission has taken over the contract of the Ontario Co-operative Building Society who have thirty houses under construction at Guelph, Ont., of which number only three have been completed. The Society's accounts were in a very complicated state and the Commission deemed it advisable to assume the contract.

The White Valley Irrigation Company, at Vernon, B. C., has been granted a further loan of $70,000, in addition to the $44,000 previously received, by the provincial government, to finance certain improvements and repairs to the company's water system. The work will be carried out with all possible haste so that water users under this system may be assured of an ample supply next summer.

The Winnipeg Housing Commission will shortly call for tenders for the construction of fifty residences in the Fort Rouge and west end districts, according to a recent statement of the Commission's secretary. This will be but the first step in the Commission's program which provides for the erection of 300 houses before next Autumn. The estimated cost of the first batch is $185,000.

By-laws authorizing the expenditure of approximately $1,500,000 on roads were passed by various municipalities throughout the province of Manitoba recently. The total mileage of roads to be built is 1,004, of permanent gravel construction with culvert and bridge structures where required. The only road building by-law turned down was in the municipality of Westburne, calling for $103,000 for the construction of 90 miles of improved road.

The contractors, Messrs. Lester Cain and J. E. Jenkinson, are rushing operations in order to have the new school at Port Arthur, Ont., completed by the specified date which is January 1, 1920. The site of the new school, which is bounded by Red River Road, Pine Street and Madeline Street, is ideal, being practically the highest point of land in Port Arthur. The new school contains seven classrooms of uniform size, a larger room for the kindergarten, principal's room, teachers' room and library. Tapestry brick is used in the construction, while foundation is of reinforced concrete to grade and Bedford and Indiana stone above grade. The interior woodwork for doors, bases, etc., will be of Georgia Pine throughout and the floors are finished with Marbleoid. The building is practically fireproof throughout.

Personal

Mr. Geo. J. Guy, chairman of the Hamilton Harbor Commission, has been appointed vice-chairman of the Canadian Deep Waterways and Power Association.

Mr. E. J. Smith, formerly Secretary-Treasurer of Jas. A. Wickett, Ltd., general contractors, Toronto, recently left that position to become associated with Wells & Gray.

Mr. Henry Hymmen, who, for the past nineteen years, has been superintendent of the Kitchener, Ont., waterworks, has resigned this position in order to become manager of the plant of the Dominion Products Co., Guelph, Ont.

Mr. Lewis D. Walker is leaving the engineering staff of the British-American Nickel Corporation, Deschenes, Que., which he joined last March on his return from overseas, to take a position at waterworks engineer and inspector for the Canadian Fire Underwriters' Association, Toronto.

Mr. J. Campbell Brady, of the British Columbia public works department, has been promoted to the rank of district engineer and will be in charge of No. 6 district, with jurisdiction over Cranbrook, Fernie and Columbia ridings.

Mr. Pierre Charton, of Charton and Beique, civil engineers, Montreal, has been awarded the Croix de Guerre and been mentioned in the orders of the day, for his conduct at the front during the war. Mr. Beique is a naturalized Canadian, being of French birth, and volunteered for duty with the French Army. He distinguished himself while commander of the 6th Regiment of Engineers, and as liaison officer between the Railway Sappers and British Army.

Mr. Marcel Pequegnat, former assistant city engineer of Kitchener, Ont., has been appointed superintendent of the Water Commission to succeed Mr. Henry Hymmen who resigned recently. Mr. Pequegnat has been in close touch with the affairs of the Commission for some time in the capacity of advising and consulting engineer and is therefore especially qualified to fill the position. Mr. Pequegnat was for several years demonstrator at the School of Practical Science, Toronto.

Obituary

Mr. Alexander Bourgeois, engineer, of Ottawa, Ont., died recently at the age of 59 years. Mr. Bourgeois was born in Joliette, Que., and took up residence in Ottawa at the age of 13. He had been employed in the Public Works Department for the past 28 years.

After but a week's illness, Mr. Oscar Beaudry, contractor, of Montreal, died in that city recently from congestion of the lungs. Mr. Beaudry, who was 56 years of age, was well known in Ottawa, having lived in that city all his life until three years ago when he took up residence in Montreal.

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks, Sewerage and Roadways

Chatham, Ont.
By-law passed authorizing the carrying out of the Thames River proposition including 4 miles 22 in. wooden pipe, pumping station, rapid sand gravity filters and elevated tank, at an estimated cost of $300,000 for City; clerk, W. G. Merritt. Engineers, E. A. James Co., Excelsior Life Bldg., Toronto.

Foxwarren, Man.
By-law for roads throughout Municipality of Ellice passed. Tenders will be called. Clerk, H. Denham, Foxwarren.

Guelph, Ont.
Tenders received until Jan. 19th by F. McArthur, engineer for City, for the manufacture and delivery f.o.b. cars, of approximately the following quantities of wood pipe, to be used in the construction of a water supply conduit: 1,500 ft. of 8 in., 1,500 ft. of 12 in. and 15,000 ft. of 24 in

Hamilton, Ont.
By-law passed approving of construction of storm over-flow sewers to cost $850,000 for City. Clerk, S. H. Kent.

Ratepayers have passed by-law approving of improvements to highways costing $50,000 for City. Clerk, S. H. Kent.

Kitchener, Ont.
Waterloo County Council plans to build a concrete road from Galt to Hespeler and to the borders of Waterloo County between Guelph and Hespeler as part of provincial county highway system. Wellington County officials are asked to consider construction of their portion of the road from Guelph to meet it. Clerk for Waterloo County, S. Cassel, Kitchener.

London, Ont.
By-law passed authorizing expenditure of $100,000 on construction of reservoir and mains, total cost $500,000, for City.

Oshawa, Ont.
Gore, Nasmith & Storrie, engineers, 409 Confederation Life Bldg., Toronto, will report on additions to the sewage system and the construction of a sewage disposal plant for Town. Clerk, Thos. Morris, Oshawa.

Penticton, B. C.
By-law will be submitted in January for new domestic water reservoir for equalizing and fire protection purposes at cost of $12,000 and for extension of water mains to cost $23,000, for Town. Address town clerk.

Russell, Man.
By-law for roads throughout Municipality passed. Tenders will be called. Clerk, A. B. Callin, Russell.

Scarboro, Ont.
By-law passed re construction of Water system to cost $300,000 for Scarboro Township; clerk, W. D. Annis, Scarboro. Engineers, E. A. James Co., Excelsior Life Bldg., Toronto.

St. Martin De Beauce, Que.
Municipality plans to gravel Front Rd. Sec.-treas., E. E. Poulin, Bolduc, Que.

St. Sylvestre, Que.
Town plans gravelling of roads. Sec.-treas., J. A. Payeur.

St. Vital, Man.
Municipality of St. Vital plans concrete paving on St. Ann Rd. Tenders will be called.

Thedford, Ont.
Lambton County Council plan road improvements to cost $20,000, also purchase of stone crushing and road building equipment. Chairman, John B. Woodhall, Thedford.

Toronto, Ont.
Tenders received until Jan. 20th by Mayor T. L. Church on construction of following sewers for City: Dufferin St., relief sewer, Boultbee Ave., relief sewer, Sterling Rd., relief sewer, Chaplin Cres., Duplex Ave. and Lawton Ave.

Railroads, Bridges and Wharves

Calgary, Alta.
City engineer, Mr. Craig, is preparing plans for $207,000 bridge to cross Bow River. Work will be done by day labor; tenders will be called for 12,000 barrels of cement and the necessary structural steel. City Commissioner, Mr. Graves.

Granby, Que.
Montreal & Southern Counties Rly. Co. will build bridge over Yamaska River for use of cars, vehicles, etc. Owner, City Council; secy.-treas., Arthur Monty.

Prairie Siding, Ont.
Townships of Tilbury East, Raleigh and Dover have petitioned Dominion Government to erect steel bridge costing $200,000 over Thames River.

Vancouver, B. C.
Consolidated American Terminal Association, 1950-50 Church St., New York, plan to erect railway and marine exchange building to cost $50,000,000; president, A. P. Gillies. Expert Service Terminals report by Barclay, Parsons & Klapp Co., 60 Wall St., New York.

CONTRACTS AWARDED

Acton, Ont.
Trafalgar Township Council awarded general contract for $120,000 bridge to span 16 Mile creek at Acton, Ont., to Norman McLeod Ltd., Kent Bldg., Toronto.

Ottawa, Ont.
Maritime Bridge Co., New Glasgow, N. S., have general contract for pontoon pipes for Dominion Dept. Public Works.

Victoria, B. C.
Robertson & Partners, 522 Metropolitan Bldg., Vancouver, have general contract for round house costing $30,000 for Canadian National Rly., head office, Toronto. Contract includes erection of round house, turn table and machine shops.

Public Buildings, Churches and Schools

Calgary, Alta.
Tenders received until Feb. 5th by R. C. Desrochers, Ottawa, for post office for Dominion Dept. Public Works. Specifications with Chief Architect, Ottawa, Resident Architect, care Receiver General's Bldg., Calgary, and Builders Exchanges, Winnipeg, Toronto and Montreal, Post Office, Brandon and Winnipeg.

Clinton, Ont.
Town plans erection of school to cost $75,000. Mayor, A. T. Cooper.

Herbert, Sask.
By-law re erection of union hospital to cost $40,000 for Town of Herbert and adjoining municipalities will be submitted April first. Plans with Provincial Govt., Regina.

Montreal, Que.
L. E. Gingras, 1281 Berri St., is altering building for dance hall at cost of $5,000. Work done by day labor under supervision of architect, P. L. W. Dupre, 15 St. Lawrence Blvd.

Ottawa, Ont.
Dominion Govt. Dept. R. N. W. M. Police plan to erect barracks. Minister, N. W. Rowell; commissioner, Mr. Perry.

Perth, Ont.
By-law for erection of memorial hospital to cost $75,000 for Town will be submitted on Jan. 12th. Clerk, John A. Kerr.

Toronto, Ont.
By-law re erection of live stock arena to cost $800,000 for City passed. Mayor, T. L. Church, City Hall.

W. W. Pearse, sec.-treas., 155 College St., calls for tenders until Jan. 22nd on all trades for addition to Earl Grey School, also addition to Wilkinson St. School for Bd. of Education.

Vercheres, Que.
R. C. School Commissioners plan erection of school to cost $50,000. President, M. Beaudry; probable architect, P. L. W. Dupre, 15 St. Lawrence Blvd., Montreal.

Windermere, Ont.
The Windermere Golf & Country Club Ltd. have been incorporated and have secured 144 acres with buildings which they plan to alter. An 18 hole course will be laid out. Sec.-treas., J. Stanley Livingstone, 45 Scott St., Toronto.

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Convention of Provincial Builders' and Supply Association of Ontario

A MEETING of the executive of the Provincial Builders' & Supply Association of Ontario was held at the Builders' Exchange Rooms, Toronto, on Jan. 6 to make arrangements in connection with the programme of their coming annual convention. The convention is to be held in Toronto, at the King Edward Hotel, Tuesday, Wednesday and Thursday, Feb. 10, 11 and 12, and there is a wide-open invitation to every man in the Province connected with the building and construction industries to attend. The secretary, Mr. Wright, is sending invitations to every exchange and builders' association in the Province asking that as many of their members as possible come to the convention. He is also getting in touch, as far as possible, with the trade in towns where exchanges do not exist in an effort to get the men who are as yet members of no organization to come and see what organization is doing and can do for the building and construction industry.

A general convention and entertainment committee, consisting of Messrs. P. L. Fraser, W. E. Dillon and Chas. T. Penn, has also been appointed, to see to it that those attending the convention will have an interesting and enjoyable, as well as a profitable, time. It is proposed to have a mid-day luncheon each day, followed by an address by some prominent speaker, on a topic of interest to the trade. There will also be a big dinner, probably on the second evening of the convention. These are merely some of the entertainment features. Subjects of vital interest and importance to the building and construction industries will be brought before the convention. Committees will be selected to discuss many of them and introduce them for the consideration of the general assembly. Chairmen have already been appointed for a number of committees, as follows: Resolutions Committee, R. Marson, Stratford; Committee on Joint Industrial Council of the Building Trades, N. Gibbs, Sarnia; Technical education and apprenticeship, E. R. Dennis, London; Universal building by-laws for Ontario, C. F. Till, Toronto; International agreements, H. Hayman, London; Organization, membership and publicity, P. L. Fraser, Toronto; Legal affairs, Mr. Norton, Sarnia; Lien Law, W. E. Dillon, Toronto; Workmen's Compensation Act, Geo. Gander, Toronto; Code of Ethics, M. F. Gibson, Toronto.

Many other important matters besides the above will be brought up for discussion, and President Elgie and his executive feel confident that the convention will be the most profitable and enjoyable in the history of the Association. It will be worth your while to attend. Remember the dates, Feb. 10-11-12, and the place, King Edward Hotel, Toronto.

Engineers and Architects Urge Improved Contract Forms

CONTRACT forms generally accepted as standard are greatly needed at the present time in order to stabilize practice in letting and carrying on construction work. Not only must these forms be absolutely fair in fact, but they must be recognized as such, and brought into general use if their full value is to be gained.

For these reasons, engineers and architects as well as contractors are expressing much interest in the work being done by the Committee of Contracts of the Associated General Contractors of America, which intends later to present definite recommendations to the Association concerning contract forms.

The results of this study would then be placed before the technical societies for suggestions and approval. Comments of much value have already been received from many engineers and architects. The following conclusion is quoted from a letter received from J. Edwin Hopkins, of the McCormick Company, Inc., architects and engineers and printed in the newsletter of the Associated General Contractors.

"I am inclined to believe that if your Association can arive at a conscientiously prepared contract form, absolutely fair and protecting the interests of the owner, the contractor, and the architects or engineers who act as agents for the owner, much misunderstanding and friction would be eliminated and those of inexperience or ulterior motives controlled thereby. You will agree with me that there are a number of incompetent men practising the profession and operating in the sphere of the contracting world, respectively, who are suffering from a lack of experience, shoddy methods, and wilful mal-practice, and that equitable contract forms, generally recognized, would very effectively remove much of the opportunity now offered these men for harm."

Find Many Poor Building Contracts

In explaining the interest of his firm in the matter of contracts, Mr. Hopkins states that they are confronted with many types of building contracts that are found to be lax, incomplete, or extremely partial as they refer to the owner, the contractor and the architect. Often these contracts are advanced by local contractors who apparently are not familiar with, or are unwilling to accept documents in more general use. Mr. Hopkins' letter continued as follows:

"This organization has been accustomed to using the uniform contract as originally adopted by the National Association of Builders and the American Institute of Architects, but since the status of this contract has been superseded in many states and cases by the documents of the American Institute of Architects, we have attempted to use these documents, and even in this case there is some confusion on the part of the contractors in the smaller cities in various states, due to their unfamiliarity with the A. I. A. forms.

"I have read with interest the article on 'Scrap Book Contracts,' which, of course, do not work to the best interest of those governed by such documents, and many times cause confusion, friction, and ultimately litigation. This article in my estimation applies not alone to young engineers fresh from college, but also to young ambitious contractors who many times present rather difficult and unintelligent proposals and contracts to owners, particularly in the case where the architects or engineers controlling certain operations are unable to guide the closing of contracts, by reason of their great distance from the seat of operation.

Both Engineers and Contractors at Fault

"Please understand that I also consider the documents of the American Institute of Architects an admirable medium governing the procedure of building operations and have used them in a number of cases, but to be frank with you, I find that when these forms are submitted to contractors in the smaller cities and towns throughout the country, they invariably are skeptical and take exception to these documents, preferring to use their own local forms which in instances such as ours can hardly apply intelligently. For this reason, I am exceedingly interested in the consideration that your Committee of Contracts is giving to this matter, for undoubtedly you can strike a happy medium and possibly in a briefer form, which would eliminate any feeling of doubt or suspicion in the preliminary procedure of a building operation.

"I write you at length because of certain unfortunate experiences which have occurred in my activities for this company in the states of Michigan, Georgia, Rhode Island, Kentucky, New York, and Maine where both the owner and contractor have materially been affected by a lack of mutual understanding as to the proper contract to govern their building operations.

"This organization has always adopted the attitude that the owner and contractor stand on the same level and in our handling any work we know absolutely no partiality to either the one or the other, and in cases where we find an attempt on the part of the owner to take advantage of the contractor, we protect the contractor, and vice versa.

"You make mention of cost plus contracts which during the present time seem to be finding favor amongst general contractors. We have been compelled to use such contracts, but in doing so, we prefer to include either a participation clause or profit sharing clause, the idea of which is to offer an incentive to all parties concerned to give closer co-operation on the work."

"In other words, and under present day conditions, we find that if a contract is entered into between owner and contractor on the basis of a conscientious guarantee price, plus the contractor's legitimate percentage of profit, a further beneficial step is to state in the contract that if the total cost of the work exceeds such guarantee price, the contractor is to share the loss or excess with the owner on any basis that is mutually agreed upon, whether it be half and half, one-third and two-thirds, or some other division.

"In like manner any saving that can be affected which would nominally be a profit would be shared between the contractor and the owner on the same basis."

Report Gives Timely Study of Development of Our Resources

STUDENTS of Canada's resources and of the problems associated with their efficient development will find a serviceable addition to the literature on this subject in the tenth annual report of the Commission of Conservation.

A concise review of the year's work is furnished by Mr. James White, Assistant to Chairman. A series of unusually informative contributions includes "Housing, Town Planning and Municipal Government" by Mr. Thos. Adams; "Medicine in War" by Dr. C. A. Hodgetts; discussions on various phases of forest conservation by Mr. Clyde Leavitt, Dr. C. D. Howe and Mr. Roland D. Craig; and of agricultural investigations by Mr. F. C. Nunnick. Particularly timely studies of the water-power and fuel situations in Canada are presented by Messrs. Arthur V. White and Leo. G. Denis.

The publication will not disappoint the very wide circle of readers to whom it affords an instructive annual resume of problems and progress in respect to the intelligent use and study of our natural resources.

Employers of Engineers Urged to Adopt Salary Schedule

THE Toronto Branch of the Engineering Institute of Canada has sent a copy of the salary schedule as recently adopted by the branch to all employers of engineers in the Toronto district accompanied by the following letter:

"The Toronto Branch of the Engineering Institute of Canada send you herewith minimum salary schedule adopted and recommended by them for 1920 and respectfully urge its acceptance by you for the engineering staff in your employ in this district.

"The rates shown are based upon pre-war conditions, no allowance being made for the present abnormal cost of living.

"If from its condensed nature the bearing of the above classification upon your organization is not apparent, we shall be very glad to render any service desired.

Canada's Engineers—G. A. McCarthy

Mr. George A. McCarthy, the subject of our biographical sketch this week, has long been prominent in engineering work in Canada, latterly as the engineer in charge of the railway and bridge section of the Toronto Department of Works. From his sixteenth year he has been engaged in engineering work, chiefly in connection with railway development. Mr. McCarthy was born in Moncton, N.B., in 1871, and from 1887 to 1894 was employed in the engineering department of the Intercolonial Railway at Moncton, under the chief engineer, P. S. Archibald. While in the service of this company he worked up through all junior engineering positions concerned with the location, maintenance and construction of railways. He then entered McGill University, and in 1898 received the degree of Bachelor of Applied Science in civil engineering. Following his graduation he was engaged until 1900 on the Lake Superior Division of the C. P. R., in charge of a party on track centering and general maintenance between Fort William and Cartier. The East called him again in 1900 and he went to Fort Hood, C.B., as engineer and acting manager of the Port Hood Coal Co. His work in this connection included the opening up of an abandoned coal mine and the building of a loading pier. The following year he became locating engineer and later was in charge of the office at Sault Ste. Marie, under the chief engineer of the Algoma Central Railway Co. From 1901 to 1905, Mr. McCarthy served as principal assistant engineer on the construction of the Hydro-electric development of the Canadian Niagara Power Co. at Niagara Falls, Ont. He held the position of chief engineer of the Temiskaming and Northern Ontario Railway Commission from 1905 till 1909, when he moved again to become western manager of the consulting engineering firm of Smith, Kerry and Chace (now Kerry & Chace), Toronto, in charge of hydro-electric development at Horse-shoe Falls on the Bow River, with transmission lines to Calgary and Exshaw. This project was carried out by the Calgary Power Co. A general miscellaneous engineering business was also handled, which called for Mr. McCarthy's residence at Calgary, Vancouver and Boise, Idaho. In 1913 he became resident engineer on the hydro-electric development at Belden on the Feather River, California, for the Oro Development Co. of San Francisco; for financial reasons operations had to be suspended before this work was very far advanced and Mr. McCarthy came to Toronto to take charge of the railway and bridge section of the Department of Public Works, which position he has since occupied with splendid success.

Mr. McCarthy is a member of the Engineering Institute of Canada, a member of the American Society of Civil Engineers, a member of the American Institute of Electrical Engineers, and a member of the American Railway Engineering Association. In 1916 he was chairman of the Toronto Branch of the Engineering Institute of Canada, and is at present a member of Council of the parent society. During the war Mr. McCarthy did exceedingly valuable work as chairman of the Inventions Committee of the Joint Committee of Technical Organizations, which drew a special recognition from the British Government, and in 1918-19 was chairman of that body.

Mr. Geo. A. McCarthy

"See pages..........to.........for classification of engineers employed by you.

"This schedule is being forwarded to all employers of engineers in this district."

This procedure is in accordance with the action taken at a meeting of the Executive Committee held on Dec. 15th, when the following motion was carried:

Moved and Seconded.—That copies of the salary schedules as adopted by the Toronto Branch be forwarded to all employers of engineers in this district, with covering letter to be drafted by a committee composed of the Chairman, Mr. Harkness, and Messrs. Chipman, McCarthy and Professor Gillespie. And that the Council and other Branches be notified of our action.

Board of Commerce Declares Building Materials are Necessaries of Life

THE Board of Commerce, in a judgment issued recently and signed by Judge Robson, Chairman, and Commissioners O'Connor and Murdoch declares that building materials of all kinds, plumbing fixtures and building hardware, are necessaries of life under Part Two of the Combines and Fair Prices Act. The order reads:

"It is hereby declared that building materials of all kinds ordinarily or necessarily used in the construction or sanitary completion of houses for homes, including plumbing fixtures and building hardware, are necesaries of life under Part Two of the Combines and Fair Prices Act. This special regulation is made pursuant to Section 16 of said Act.

"It is further ordered that prior to March 31, 1920. all dealers within Canada in such building materials do deliver to the Secretary of the Board of Commerce of Canada at Ottawa, a statement showing the cost to them of each article or class of building material being sold or being offered for sale, with their selling price thereof to a contractor or other individual for use in the building of houses, and stating the dates as of which such cost and selling price is reported.

"And it is declared that any dealer or dealers holding or offering for sale within Canada such building materials will hereafter be deemed to have committed an offence under the Combines and Fair Prices Act, 1919, if an unfair profit is made by them or him in the sale of such building materials."

Pruneau & Co. Ltd., Quebec, has been incorporated with a capital of $90,000 to acquire the business of Pruneau & Co. Regd., sellers of building supplies.

Simpson Mail Order Building at Halifax

Constructed Rapidly Under Cost-Plus-Fixed-Fee Form of Contract in Spite of Labor and Weather Difficulties

By F. A. Wells*

THE new Mail Order Building at Halifax, Nova Scotia, just completed by Wells Brothers Construction Co. Ltd. for The Robert Simpson Co. Ltd., Toronto, is not only a structure creditable to the owners for their determination to erect more than a mere utilitarian warehouse but an excellent example of the economy of time and money possible under the fixed-fee contract.

Decision to build was made in the middle of June, 1919 and, following a conference with the architect, N. Max Dunning and the builder who had successfully handled previous construction for the owners at Regina, Sask., and later at Toronto, a contract was made on June 23, with the understanding that absolutely no effort would be spared to have the structure ready for occupancy before the year ended. The promise was made good. Liebermann, Klein & Hein were retained as engineers.

Past work had been done under a fixed-fee contract which had worked out so satisfactorily to the owner that it was again adopted. In fact it was the only possible basis because of the vital necessity that work start long before finished plans could be ready.

The site was two-thirds covered with a virgin pine forest. Prior to the receipt of foundation plans, which arrived on July 25, the site had been cleared and general excavation carried as far as possible.

One-Half of Proposed Unit

The present building, one-half of the proposed unit, is 200 by 100 feet in plan, sprinklered, and of five storeys with a mezzanine between the second and third floors. It is of flat slab construction with 9-inch floors and 24 ft. 1 in. square panels. The distinguishing feature of the building is the large expanse of glass obtained by holding the round exterior columns back of the wall line and making steel sash continuous over six panels. This gives much additional light and a much more effective external appearance than where all structural members are all exposed. The typical floor height is 12 feet 9 inches except for second storey which is 18 feet 9 inches to accommodate the mezzanine The interior of the building is smoothed and brushed for cold water paint, floors are finished cement and the stairs are of steel with cement tread. Stair wells and elevator shafts are enclosed in brick.

In addition there is a 62 by 52-ft. power house connected with the main building by a tunnel through rock, a 90-ft. radial brick chimney and a concrete septic tank located 200 feet from the building to take care of sewerage. The power house is designed to take care of the second unit and equipped with two 110-horse power boilers with provision for a third. The main building is heated by hot water under forced circulation, a heat exchange being installed in the power house.

Labor Difficulties

Montreal was the closest market for steel and cement, and Cheltenham, Ont., for face brick, only red face brick being produced at any nearer point. This added a freight charge of $13.25 per thousand to an $18.00 brick. Prism glass for the upper two rows of lights was ordered through a Canadian house from stock in England and numerous cables urged prompt shipment.

The labor situation was very difficult. There was considerable other masonry work in the vicinity and about one-half of the bricklayers were brought from Montreal.

Many practical difficulties were encountered such as the necessity for blasting for a tunnel beneath the first floor slab as well as for tunnels to the power house and to a water main at one corner of the property. The rock was full of water bearing seams, necessitating almost constant pumping, and had to be blasted with small charges to avoid structural dam-

A construction view of the Halifax mail order building of the Robert Simpson Co. It measures 200 by 100 ft. and is of flat slab reinforced concrete construction. Building was erected complete in six months.

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*Vice-president and secretary, Wells Bros. Construction Company of Canada, Ltd.

One feature of the design of the Simpson mail order building is the excellent lighting obtained by keeping exterior columns back from the wall line and making steel sash continuous over six bays.

age. Trenches were in some cases 10 feet deep, due to surface inequalities.

Due to the urgent need for speed, work was at all times prosecuted to a point where further progress must await receipt of essential materials. The first reinforcing steel arrived on August 18 and the first slab was poured on the third day following. The roof slab was finished on October 4. Out of 38 week days during which concrete was being poured in foundations and superstructure, rain occurred on 16 days.

The expectation of difficulties was fully realized but the structure was ready for full occupancy when needed, just six months after the contract was signed. On December 20 the last passenger elevator was in operation and only some details of the steam heating and decorating subcontract remained to be completed.

Work without Finished Plans

Manifestly no contractor could guarantee the cost of such an operation nor give an absolute time for completion, but the fortunate relationship under the fixed-fee contract gave incentive to the builder to make every possible effort to do the work on time and to hold to the lowest possible net cost. In being able to start work without finished plans and to proceed as fast as details were ready (a procedure permissible only under the fixed-fee plan), fully six weeks were saved.

Toronto To Seek Readjustment of Town Planning Zone

THE Assessment Department announces that Toronto will shortly apply to the Ontario Railway and Municipal Board for confirmation of plans of subdivisions outside the city, covering 24,000 acres. These are situated within the five-mile limit, which the Town Planning Act enables Toronto to control. An even more impotant announcement is that the city will ask the board to set new boundaries for the town-planning zone, and also change the zones of various municipalities inside Toronto's zone. This proposition will, of course, be first submitted to the municipalities concerned.

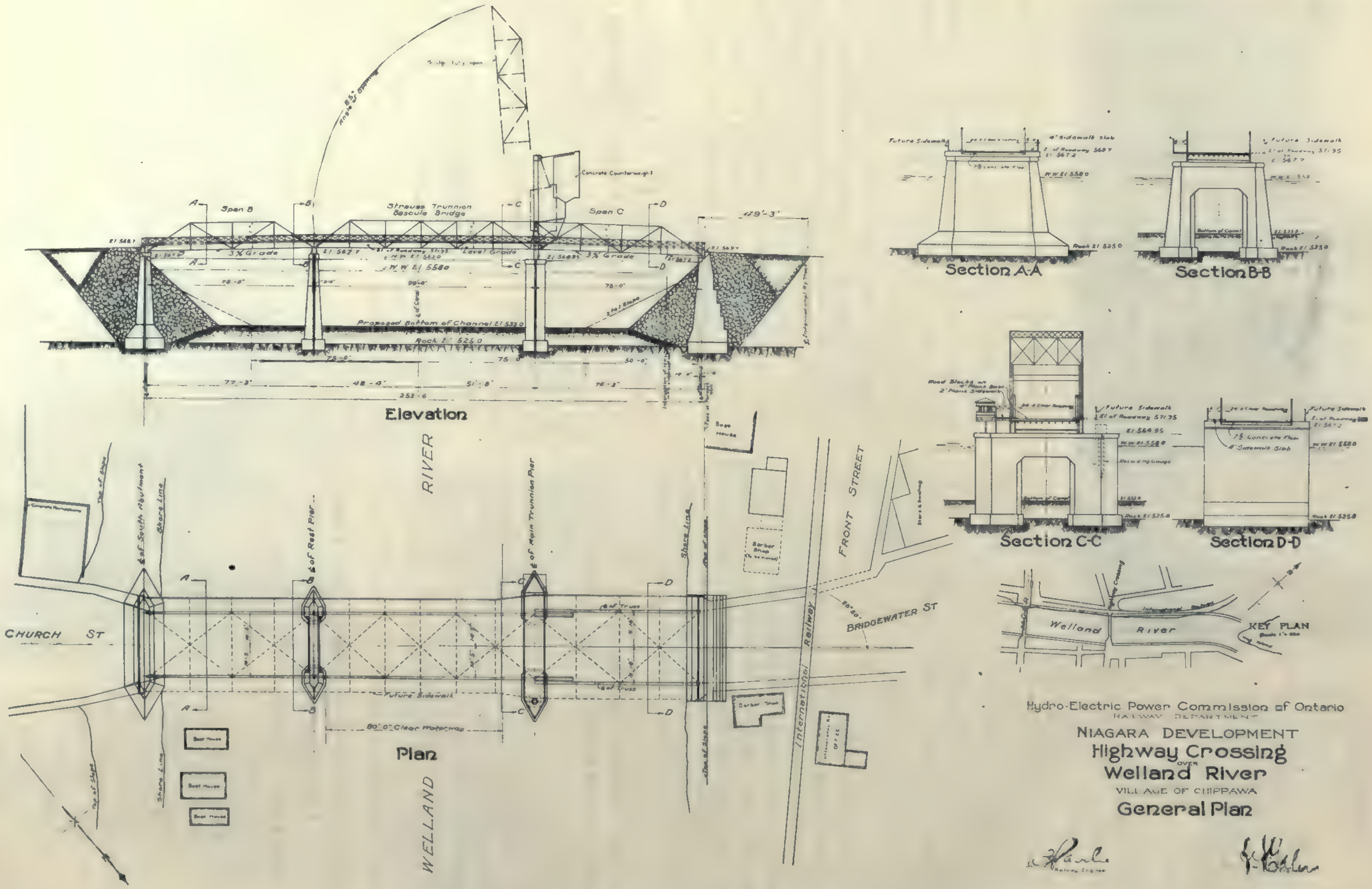
So little has been said about Toronto's town planning scheme that few citizens are even aware that there is one. Under the statutes, the city controls sub-divisions within five miles of its limits, while towns and villages control subdivisions in the country within three miles of their limits. The result is that there are tracts of land which cannot be subdivided and registered without the consent of as many as four different municipalities. Mimico and New Toronto, for instance, have a say as to land within their three-mile limit which is also within the five-mile limit of Toronto. A movement is now on foot to limit the juisdiction of the various municipalities so that there will be no conflict of authority. Under the Act passed in 1918. the zones may be altered if the Railway Board consents, and it is understood that Toronto will not only seek an extension of her own zone, but a readjustment of various others.

Montreal Branch, E. I. C., to Entertain Guests at General Meeting

The following letter has been sent to each member of the Montreal Branch of the Engineering Institute of Canada by the secretary of the branch. It is in reference to the annual and professional meeting of the Institute:

The Council of The Engineering Institute of Canada has authorized the Montreal Branch to hold a Professional meeting in conjunction with the Annual Meeting of The Institute, on January 27, 28 and 29, 1920. In former years when the Annual Meeting of The Institute was held in this city it was customary for the Montreal members to entertain the out-of-town members to a certain extent. This year, however, the Montreal Branch has the privilege, for the first time since its formation, of acting as host for the meeting, and great efforts are already under way in order to make the meeting an unqualified success and attractive in every way to out-of-town members as well as to the members of the Montreal Branch.

With this end in view, in addition to the business and technical part of the programme, a social programme is being prepared. It is proposed to hold at least one Luncheon (in addition to that at which the Northern Electric Company will be the host); a Reception, at which there will be cards, dancing, music and supper; and a Smoking Concert, which will compare favorably with any theatre entertainment and have the added advantage of sociability, all in addition to the regular Annual Dinner.



General design features of steel highway bridge over Welland River at Chippawa, Ont.

In order that this programme may be successfully carried out every member of the Montreal Branch is being invited to subscribe to the Annual-Professional Meeting fund, as it is felt that every member is desirous of lending a helping hand for the proper entertainment of our guests. Will you, therefore, kindly send your contribution to the undersigned at your earliest convenience.

For your guidance it might be stated that the the meeting of the Branch held on December 18th the members present indicated the amounts of the subscriptions, large and small, they were willing to make, and the average contribution from each Member, Associate Member, Associate, Junior or Student present amounted to approximately $7.00.

Frederick B. Brown,
Secretary-Treasurer,
260 St. James Street, Montreal.

Steel Bascule Bridge Over Welland River

Highway Structure Required at Chippawa, Ont., as Result of New Flow Channel for Power Development

IN connection with the Queenston-Chippawa development of the Hydro-electric Power Commission of Ontario at Niagara Falls, a great deal of bridge building—approximating $1,500,000 in value—is entailed. This extensive programme has been required on account of the necessity of carrying a number of railways and highways over the new flow channel, comprising a 13-mile canal from Chippawa, about two miles above Niagara Falls at the mouth of the Welland River, to Queenston, about a mile above the Lake Ontario end of the Niagara River. For railway purposes, three reinforced concrete arches are needed, one for the Niagara, St. Catharines and Toronto Railway (electric), one for the Wabash Railroad, and one for the Grand Trunk and Michigan Central Railroads. Besides these two steel railway bridges and a number of highway and foot bridges are required to carry the various roads across the canal. Two of the big arches have been completed and work is proceeding or will proceed shortly on all the other structures.

One of the large highway bridges involved on account of this power development will be located in the village of Chippawa at the point where the boulevard of the Queen Victoria Niagara Falls Park Commission crosses the Welland River. This stream is being widened and deepened to serve as a portion of the flow channel and on this account the existing bridge has to be replaced. The structure heretofore serving the demands of traffic on the boulevard is quite inadequate as it is of timber truss construction with only a 10-foot roadway, and its replacement would have been necessitated in the near future in any case.

One Bascule and Two Fixed Spans

The Hydro-electric Power Commission, through its railway engineering department, has prepared designs for a new structure at this point, the general features of which are illustrated in the drawings herewith. On account of the navigability of the channel and its connection with Port Robinson on the Welland Ship Canal, it was necessary to incorporate in the design a movable span, as the clearance between deck and water level is very low. For this reason the bridge will consist of a 100 ft. steel bascule span and two fixed 75 ft. steel approach spans, carried on reinforced concrete piers and abutments. The trusses are of the through pony Pratt type, 12 ft. in depth. In one approach span and the bascule span they are placed at 29 ft. centres, but in the approach span next the trunnion end of the bascule span they are at 32 ft. 2½ in. centres, the extra spacing being arranged to allow the short arm of the bascule span, carrying the counterweight to fit between the approach trusses when the bridge is in its open position.

The movable span is a Strauss trunnion, single-leaf bascule design, with a vertical overhead concrete counterweight. The trunnions are secured to the top chord and mounted, as is usual in this type of bridge, in journal bearings supported by vertical trunnion posts, anchored to the pier. The span is to be electrically operated with a hand emergency control.

The roadway is 24 ft. in the clear, the deck on the approach spans consisting of a 7½ in. concrete slab. On the bascule portion, a 4 in. plank base with wood block wearing surface is employed to keep the weight of the span at a minimum. Two 6 ft. cantilevered sidewalks are provided for, although one only will be built at present. A 4 in. concrete slab is used, except for 2 in. plank on the bascule span. The fixed spans are placed on a 3 per cent. grade toward the bascule span.

Piers in Thirty Feet of Water

The piers and abutments, of the type shown in the drawings, are carried down to rock, which is 8 ft. below the proposed bottom of the channel. They are placed in 30 ft. of water by means of caissons built on shore and floated to place. Their construction is being carried out by the Commission's forces.

The bridge is designed for class "C" loading as laid down in the general specifications for steel highway bridges by the Department of Public Highways of Ontario. Bridges of this character are classed as suitable for main travelled or county roads. They have to sustain a concentrated live load of 20 tons on two axles at 10 ft. centres and 6 ft. guage, two-thirds of the load to be carried on the rear axle. The uniform live loading is considered as 135 lbs. per square foot of floor space.

The cost of the structure is being borne by the Hydro-electric Commission and the Provincial Government. The substructure is being built by the construction forces of the Commission, but the steel work has been let by contract to the Hamilton Bridge Works Co., Ltd., of Hamilton, Ont., who must supply and erect the superstructure ready for operation by July 1, 1920. The engineering is under the supervision of the railway department of the Hydro-electric Power Commission. The chief engineer for the Commission is F. A. Gaby, and the railway engineer is T. U. Fairlie.

Details of Rushbrooke St. School at Verdun, P. Q., Recently Completed

THE Rushbrooke St. School, Verdun, for the Protestant School Trustees, was completed recently at a cost of $95,000. The building has accommodation for about 400 pupils, and provision has been made for additional wings if necessary.

The exterior construction is of concrete, with a certain amount of ornamentation. The spaces between the columns and beams are filled in with brick, the side and rear walls being of the same material. The window sashes throughout are of wood. In the interior the walls have a backing of terra cotta, plastered. The partitions between the class rooms are of terra cotta, with a plaster finish. The floors are of hardwood.

The building consists of a basement and three floors. On the ground floor there are two playrooms, one for boys and the other for girls, with lavatories adjoining, also teachers' rooms. The first and second floors each provide accommodation for five class rooms, with separate cloak rooms; on the second floor there are also rooms for assistant teachers. The class and other rooms are situated on each side of central corridors.

There is a central entrance, the floors being reached by a stairway which is disconnected from the corridors by fire-resisting screens. A fire alarm system is installed; this consists of gongs in each corridor, controlled by a push button in each room.

At present the building is heated by furnaces, but provision has been made for a heating and ventilating system, to be installed when the additional wings are built.

The building was designed by Mr. D. J. Spence, architect, Montreal. The general contractors were Messrs. Archambault and Leclair, while the contract for plumbing and heating was awarded to Mr. Thos. O'Connell, Montreal.

Power Situation in Canada Improved by Remedying Faulty Conditions

By Leo G. Denis*

WHILE, on the whole, the power situation in Canada is fairly satisfactory, there are numerous problems which require authoritative consideration and action; moreover, numerous faulty existing conditions could be much improved by following proper technical advice. One or two of the latter instances may be briefly referred to here.

Although the great bulk of our power is obtained from large, up-to-date plants, where conditions are efficient and satisfactory, there are many small plants, both water-power and steam, where conditions fall far short of what they should be. Small, inefficient steam-plants should be eliminated and replaced as far as possible by electric energy. Small water-power plants offer a different aspect; they each possess inherent energy which, if not fully utilized, is lost to the community. Individually, they may not seem important, but, in the aggregate, the loss is considerable. In eastern Canada alone, including Ontario, Quebec and the Maritime Provinces, there are no less than some 1,025 water-power plants of 200 h.p. and under; moreover, these are practically all situated in the more thickly populated portions of the provinces where power is most valuable. In many instances, greater efficiency might be obtained from these plants, each site furnishing an individual problem and involving a study to ascertain what may be accomplished in the way of betterment of operating conditions. Else-

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*Hydro-electric Engineer, Commission of Conservation, in Tenth Annual Report.

Rushbrooke Street School, Verdun, P.Q.

where, we have had demonstrations that such betterment is, in many instances, easily attainable.

Increasing Efficiency of Some Plants

Among the many improvements which can increase the efficiency and output of a small plant are: Increase of head and pondage; repairing or replacing leaky dams, works, conduits, etc.; scraping and cleaning water-wheel runners; cleaning out or deepening tailrace; replacing or re-aligning all bearings to reduce friction; eliminating all counter-shafts, belting and gearing, replacing same by direct drive.

In connection with the proposed improvement of water-power plants recommended by the Legislature of Massachusetts, the consulting engineer states that the average efficiency of the wheels at present in use, most of which were installed some time ago, is probably about 65 per cent. The advance in the art of hydraulic turbine design and installation in the last decade has been very marked, and efficiencies of 85 to 90 per cent. are now attainable, which means that an additional 20 to 25 per cent. of the total power can be utilized, and that the power obtained with the same amount of water when used inefficiently can be increased by from 30 to 38 per cent.

An example of the great benefit obtained by overhauling medium sized plants was recently noted in the province of Quebec. A municipality which had two hydro-electric plants, with a total capacity of 2,900 h.p., prior to reconstruction, increased the capacity of one plant by 50 per cent. and the other by 127 per cent. Among the various changes made were the replacing of too small and inefficient turbines in one place, turbines of old design and inefficient in another, replacing a wasteful crib dam by one of concrete and reducing transmission line losses.

Power Supply for Middle West

Another question worthy of attention is that of adequate electric supply for Saskatchewan and adjacent portions of Manitoba and Alberta. The southern portion of this section of Canada is practically destitute of water-powers, and, thus far, the supply of electric energy has been largely restricted to the principal centres. Electric energy should be available in community centres for both domestic and local industrial purposes, to facilitate the promotion of such industries as go hand-in-hand with agricultural development. The present need and the requirements of the near future seem to indicate the desirability of comprehensive systems supplied from proportionately large steam-turbine plants. After a detail study of the demand at the present time and in the near future, a fairly definite plan should be worked out along the lines just mentioned. The installation should be developed to meet the demands of the market and should be developed with a view to interconnecting the various systems later on. Although the actual present demand may make this appear a rather optimistic suggestion, there is no doubt that our Middle West will continue to develop with increasing rapidity, and we should be prepared to deal with the situation should it arise.

Interconnection of Services

The great economy of interconnected electric systems is becoming more and more apparent, and, while some of the examples given involve very large undertakings, they serve to illustrate the point. Some of the advantages of interconnection are: Improvement in load factor, increased reliability of service, reduction of the necessary reserve machinery, and the net result is to improve the efficiency of the system. Electrical World of July 27, 1918, states that interconnection of energy supply systems is a matter of economic importance. It is one of the first steps toward increasing territorial load factor, and thus realizing the utmost reserve capacity in existing plants. Nor is it necessary to wait for the perfection of an elaborate plan before making a beginning. The same journal of Sept. 14th, 1918, further states that the advantages of an interconnected system over a number of small plants operating independently are readily appreciated. It cites, as a striking example, a portion of the state of Wisconsin, where on account of the greater diversity factor permitting increased peak loads, the total daily output of a plant has been increased to three times what it was before interconnection.

In the United States, just previous to the armistice, every effort was made to obtain additional electric power, and, in practically every case, interchange of energy or interconnection of systems was given precedence over all other means.

As a solution for more power with less coal, several companies in the New England States have planned interconnection which, it is estimated, would save 70,000 tons of coal yearly and increase the generating capacity by about 50,000 k.w. The 17 plants involved represent 200,000 k.w. total capacity, while the coal consumption would be reduced from 2.38 lbs. per kw.h. to 1.93 lbs. per kw.h.

With regard to greater economies in power production, the Ministry of Reconstruction for Great Britain recommended the grouping of some 600 smaller systems into 16 districts, each to be supplied from large super-power plants replacing existing inefficient plants, and capable of supplying a comprehensive electric power distribution system.

The Electric Power and Supply Committee of the British Board of Trade has recommended that existing systems generating electricity separately for small areas be abolished and that the United Kingdom be divided into districts for the economical supply of electricity.

A committee has been formed in connection with the proposed electric supply of the devasted regions of France and, as, in most cases, all apparatus previously operated has been destroyed, it will so plan the reconstruction that the many small plants will now be replaced by fewer large generating systems.

Water Storage Reservoirs

One other question should probably be mentioned; that of water conservation reservoirs in connection with the full utilization of our water-power resources. The Commission of Conservation has always taken a particular interest in this aspect of power development, and it is gratifying to note the rapid advance made during recent years in Canada. Of our hydro-electric developments alone, 59 plants report the successful operation of this method by providing for increased flow at low-water periods. Many difficulties encountered in the early years in connection with efficient operation seem to have been overcome by careful observation and study of conditions from year to year. By carefully regulating its release from conservation reservoirs, water is successfully conveyed over long distances to the power plant with a minimum of loss. Both federal and provincial governments are doing excellent work, while numerous smaller private undertakings are also in evidence, and government encouragement and help, wherever economically feasible, cannot be too strongly advocated.

Co-ordinated Operation

Another point, closely allied to water-flow regulation, is that of co-ordination in the operation of hydraulic plants, situated at short distances from each other on the same river, so as to avoid interference. It will soon become a serious problem in connection with the full production of our water-power plants. So far, possibly only one or two of the most advantageous water-power sites have been developed and utilized on each of our various rivers, and, even including our largest streams, these sites were far enough apart or had intervening compensating basins so that irregular operation would not interfere. The increasing number of sites utilized on each river is bringing them closer together, and when the plants are not operated directly by the same interests only strict and well defined regulation will avoid litigation and inefficient use of the full possibilities. It is apparent that such regulations should immediately be put into force in all provinces, thus ensuring the co-ordinate operation of water-power plants situated at different elevations on the same river.

Special Services for Concrete Construction

Mr. F. G. Engholm Emphasizes the Need of Specialists if the Use of Reinforced Concrete is Not to be Abused

On Thursday, Jan. 8, a general meeting of the Toronto Branch of the Engineering Institute of Canada was held at the Engineers' Club Rooms. The meeting was addressed by Mr. F. G. Engholm of F. G. Engholm & Partners, Canadian Licensees for the Hennibique system of reinforced concrete construction. The topic of Mr. Engholm's lecture was "Reinforced Concrete Construction." A number of features not commonly realized were emphasized and a large number of slides were used to illustrate some of the speaker's main points.

In introducing his lecture Mr. Engholm pointed out that the order of the day at the present moment is service at a price and a keen price. The commercial competition of the present day is not merely a matter of individual effort; it is now a matter of national importance and the nation conducting its affairs so as to take advantage of, and facilitate, the quick development of engineering science is going to hold a big advantage over a nation which stagnates and provides no machinery by which engineering science can be developed. The speaker stated that reinforced concrete was a material of construction which offered such advantages compared to other materials that it was entitled to the first place in the consideration of the commercial world of to-day. He felt that Canada was stagnating as far as reinforced concrete was concerned. There was no machinery in Canada by which engineering science could develop, he declared, and we had no reason to be particularly proud of our development. We were tied up with a lack of proper understanding and hampered by ill-advised by-laws.

Speaking of recent developments in reinforced concrete construction, Mr. Engholm referred to a new cement that is shortly to put on the market. It is made by mixing a chemical with the clinker before grinding and shows an increase in strength of more than 25 per cent. over ordinary cement. A new type of aggregate has also been developed. This is made by fusing clay by a special process and concrete using this fused clay in the proportion of 1:3 has shown a strength of 3,380 lbs. per square inch in seven days and 4,350 lbs. per square inch at 28 days. As the weight of concrete made with this aggregate is less than 106 lbs. per cubic foot a great economy is obtained through the reduction of the dead weight of a structure. In regard to steel, it was pointed out that by physically developing ordinary mild steel the stress of the yield point and the ultimate stress are increased. The ultimate strength of such steel is about 85,000 lbs. to 95,000 lbs. per square inch and the stress of the yield point is about 55,000 lbs. per square inch. It is possible to stress this steel to 22,000 per square inch and yet have the same factor of safety as ordinary mild steel at 16,000 lbs. per square inch.

Mr. Engholm pointed out the fallacy of existing specifications by stating that were a bridge or a building designed, taking the fullest advantage of these new developments and having a safety factor of 10, the structure would not pass either the Ontario Railways and Municipal Board specifications nor the city of Toronto by-laws, in spite of the fact that steel structures can be built under these regulations and still have only a factor of safety of four. In spite of this increase in strength by 2½ times, the structures of concrete would be considerably cheaper than those of steel.

In reference to cost, Mr. Engholm stated that concrete structures can be built to-day for 10½ cents per cu. ft. In 1912 and 1915 typical buildings cost 6.2 and 7.5 cents respectively. This low advance in cost is due to the mechanical handling of the material and re-using of the form work.

Mr. Engholm declared that there was something wrong in the situation with regard to the way in which concrete buildings are controlled, a number of reasons for which were assigned by him. "Reinforced concrete," he stated, "is a building material which is manufactured on the site and the manufacturer is the contractor. The only component part which is a finished manufactured product is the cement and the commercial power of the vested interests is small compared to the commercial power of the manufacturing interests of other building materials such as structural steel, terra cotta, brick, timber, etc. Apart from the cement manufacturers no one possesses any real power or is able to provide the necessary funds to push reinforced concrete as other materials have been pushed, and business people who are not cognizant of the real situation do not see reinforced concrete in its true light.

"If an architect or engineer employs reinforced concrete, it pays him to employ experts on account of the specialized nature of the work of design. In doing this, however, he has to obtain permission from his client, which reflects sometimes on his own ability. This, of course, is due to entire lack of understanding. If a specialist is employed, a tremendous saving can be effected and the actual cost of such special service is negligible when compared with the saving it is possible to effect over other materials of construction or when inexperienced engineers are employed to prepare the designs.

"Reinforced concrete requires thorough inspection and expert supervision in order to check up the manufacture of the materials in all its stages. Again the cost of this expert supervision is negligible compared to the results obtained, but all this comes under the head of special service and any money expended thereon is looked upon by the owner from an entirely wrong viewpoint. He does not appreciate that he gets full value for such expenditure and looks to his engineer or architect to supply such special service for nothing. When this difficulty is fully appreciated by businessmen, there will be a considerable increase in the use of reinforced concrete.

"The difficulty of providing this special engineering service has led to great abuse of concrete. In the age of the deformed bar, the market was flooded with special sections of steel bars which, like medicine, were supposed to do all sorts of things. The notches or deformations did not make any particular difference other than increasing the difficulty of handling and bending and disturbing the continuity of the fibres in the bar. Much unscrupulous competition was indulged in and many unsafe structures were built. Hence the rigid by-laws and prejudice against reinforced concrete construction.

"Very few engineers and architects, let alone the business man, appreciate the vast amount of detail work that is absolutely essential in first-class concrete construction. Where special engineering service is not provided for, this detail work is always muddled and it ends in the contractor using his own judgment and leaving everything to chance. It is the frequency of poorly engineered reinforced concrete structures that has created the prejudice against the material.

"Through the efforts of the American Bureau of Standards and the Emergency Fleet Corporation, comprehensive tests have been conducted which have shown up many fallacies and have definitely proven that many by-laws fall wide of their mark in the control of stresses. For example, if ships were to be made of concrete and comply with any existing by-laws or regulations, it would be necessary to have shells at least 15 in. thick instead of the 4 in. section finally adopted."

Mr. Engholm made some extended reference to the tests of the Emergency Fleet Corporation. These tests have proven that the shear values ordinarily accepted are absurdly small and are not borne out by the results of actual tests. It is pointed out that values as high as 2,500 lbs. per square inch have been recorded at failure, with a concrete having a compressive ultimate strength of 4,000 lbs. per square inch. Arbitrary restrictions of by-laws and specifications limiting the shear stress under similar conditions to such values as 160 or 120 lbs. per square inch are utter fallacy. It has been the practice of the speaker's concern to design reinforced concrete structures with steel taking the entire shear stresses and shear on the concrete works out to values up to 400 lbs. per square inch in ordinary mixtures and 500 lbs. in richer mixtures. The all-important thing in the reliability of concrete structures, especially against any unforeseen forces, it was pointed out, is that the steel should take all the shear.

"It is possible," stated Mr. Engholm, "that many millions of dollars can be saved in building and engineering construction throughout Canada by the proper revision of by-laws throughout the various cities. An excellent opportunity exists at the present time for the formation of a special committee of reinforced concrete engineers to study the experimental data of the Emergency Fleet Corporation and the U. S. Bureau of Standards and to make proper recommendations for changes in city by-laws. In these days, when costs of construction have risen almost out of sight and when millions of dollars of work is being held up on account of this, the manufacturing business in Canada suffers severely from the situation.

"In adopting these high stresses it must be realized that the public should be absolutely safeguarded. Under existing conditions it is not safeguarded because there is no reliable provision for construction in reinforced concrete by experts—anybody can do it. It should be up to the owner to provide adequate inspection and there should be regulations accordingly. The provision of reliable supervision for reinforced concrete design would tend to make great headway towards the best structures."

A twenty per cent. contribution to roads and bridges account of the townships of Ontario will probably be provided for in legislation to be submitted to the Legislature at the coming session. Hon. F. C. Biggs, Minister of Public Works and Highways, now has the matter under consideration in connection with the general policy of aggressive highway construction this coming season. The definite amount to be given the townships has not been fixed, but it is stated that one-fifth of the expenditure made by the townships is the sum tentatively favored by the Minister.

OTTAWA CONFERENCE OF A. C. B. C. I. CHANGED TO FEB. 2-3-4

The dates of the Ottawa Conference of the Association of Canadian Building and Construction Industries have been changed from Jan. 27-30 to Monday, Tuesday and Wednesday, Feb. 2, 3 and 4. This change in date was thought wise owing to the fact that the former dates clashed with those of the convention of the Engineering Institute of Canada, and a number of construction men are members of both organizations. It is hoped, therefore, that the change will help both conventions. The A.C.B.C.I. will meet in the Chateau Laurier, and President Anglin and the Council of the Association are very anxious to have a representative gathering of Canadian builders and contractors. The heartier the cooperation and the fuller the success of the Conference, the greater will be the benefits to the men of the building and construction industries. Remember the dates—Feb. 2, 3 and 4, and the place—Chateau Laurier, Ottawa.

The Manufacture of Portland Cement

Processes by Which Cement is Made are Described in Paper Read at the Montreal Electrical Luncheon

By H. S. Van Scoyoc*

THE invention of portland cement and subsequent overcoming of the prejudice and criticism that greet the presentation of a material that vitally affects a standard practice in engineering and construction, opened up possibilities for its utilization that are as yet unlimited. Each succeeding year marks its adoption for some new use as a component part of concrete, a material that is today recognized as the building material which will best meet the varied situations and conditions demanded by complex industrial activities.

Many of the greatest engineering works of modern times could never have been carried out without the use of portland cement concrete. It is now used in substitution for stone, brickwork, timber, steel and iron work on account of qualities it possesses which the other materials mentioned do not have to the same degree, namely flexibility in construction and permanence with low repair cost under changing climatic conditions, chemical action, action of fire and mechanical wear and tear.

It is interesting to note that the ancients recognized the value of all the materials mentioned for various purposes, concrete as well as the others. It was not, however, the concrete of today, the essential difference being the fact that hydraulic lime was the cementing material and not the cement of modern times. The history of the development of portland cement is, however, closely associated with that of hydraulic lime for it was the endeavor to obtain a satisfactory hydraulic lime, in the first portion of the 19th century that resulted in the invention of portland cement.

Manufacture of Cement

Portland cement may be divided into classes, according to the method of manufacture, which are as follows:

1. Wet process, 2. Semi-wet process, 3. Dry process.

In the wet process the raw materials are intimately mixed, ground, and fed (in the form of a slurry containing sufficient water to make it of a fluid consistency) into the rotary kilns. In the semi-wet process raw materials are ground, mixed, and burned in the dry state.

Because of the fact that the larger portion of portland cement manufactured in Canada to-day is made by plants using the dry process, the description of the process of manufacture will be confined to an account of this method.

The manufacture of portland cement itself is divided into five processes as follows:

1. Mining and quarrying of raw materials, 2. Drying and grinding, 3. Proportioning and mixing, 4. Burning the mixed materials to incipient fusion, 5. Grinding the clinker thus burned to an extremely fine powder, meanwhile adding the proper proportion of gypsum, the resulting powder being known as portland cement.

The raw materials for the greater part of the portland cement made in Canada today are; (a) Limestone and clay, shale or slag; (b) Cement rock and pure limestone.

Quarrying Raw Materials

The method of quarrying the rocks usually follows that customary in all quarry operations. The rock is dislodged from the quarry face by means of an explosive and then loaded into side dump cars or aerial trams by either steam shovel or manual labor, preferably the former. The stone is then conveyed to the stone house, where it is crushed to comparatively small sizes and then transported to storage-bins before being mixed with the other ingredients. While in storage the stone may be sampled and analyzed. Another method used is to pass the limestone, shale of cement rock through crushers and ball mills, or other preliminary grinders, from which it is conveyed to storage-bins. Tube mills which are used further on in the process are similiar in general to the ball mills.

Shale, which for practical purposes may be looked upon as solidified clay, is excavated, dried, ground, and then conveyed to the storage-bins.

After raw materials have been drawn from their respective bins and accurately proportioned by weighing, they are delivered to a screw conveyer which completes the mixing and delivers the combined material to the tube mills. The tube mills are revolving cylinders half full of flint pebbles or steel slugs which reduce the material continually being fed into practically the fineness of finished cement.

All the tube mills deliver to the same conveyer, which results in an uniform product of the raw material mill as a whole. At frequent intervals samples are taken from the belt and delivered to a sample can which is collected at stated intervals. These samples are taken to the laboratory where tests are made to determine their composition.

Treatment in The Kiln

From the tube mills the material is fed to the kilns through a system of conveyors. The kilns themselves are from 6 to 8 feet in diameter and form 60 to 200 feet long, 125 feet being the average length. They are lined with firebrick and revolve at about the rate of one revolution per minute. It is estimated that a particle of raw material takes about an hour to traverse the entire distance from the feed to the outlet. Powdered bituminous coal, crude oil, or gas is used as fuel, powdered coal being the most general. It is blown into the kiln at the end opposite that at which the raw materials enter.

The raw material entering as a powder is gradually brought to the point of incipient fusion at a temperature of 2,500 to 3,000 degrees Fahrenheit, producing clinkers varying in size from ¼ inch up to about 1½ inches in diameter. It may also be mentioned that the clinker is red hot when discharged, but is soon cooled by sprays of water or cold-air blasts which are played over the elevator and also upon the clinker when delivered to the storage piles.

From the kiln, the clinker may go (a) to the clinker storage pile for later grinding, or (b) directly to the grinding department.

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*Publicity Manager, Canada Cement Company, Limited.

Gypsum to Retard Setting

Either before or after the preliminary grinding of the clinker by jaw crusher it is usual to add gypsum, either by hand or automatically, in order to retard the setting time of the cement. Were gypsum not added, the cement would harden quickly and develop little strength. Approximately two pounds of gypsum are added to every 100 lbs. of clinker. This is controlled by the chemist from analysis of the finished cement and from the setting determinations made hourly in the physical laboratory.

After the gypsum has been added, the material is delivered to the tube mills, which complete the grinding. These tube mills are similiar to those which grind the raw material, and are also half full of flint pebbles, or steel slugs which rotate and grind one against the other, reducing the cement to the fineness with which everyone is familiar. There are also special grinding machines which supplement the tube mills. Frequent samples are taken of the finished product. It is customary to make up test pats every hour and briquettes twice a day, while in the chemical laboratory complete analyses are continually being made of the finished product, as well as of the raw materials which enter into its composition.

The bins used for storage are similiar to those used in storing grain. The material is deposited in these bins by means of a conveyor belt with a tripping mechanism which can be run from one end of the house to the other. The cement is drawn out from below through holes in the floor, delivering to screw conveyors underneath. A peculiarity noted in drawing cement or other material is that when drawing is started, the cement comes as an average of the entire bin. If, for example, only one hole is opened below the bin, the top surface will "cave" slightly after the drawing is continued for a short time, and from then on small portions are observed to fold in from the outside of the crater, indicating that an average of the entire stock is being delivered below. From each of the tunnels conveyors carry the cement to large elevators, which raise it finally to large hoppers above the packing floor, on which are installed packing machines. A cement sack may be filled (when packing machines are used) through the bottom, and not through the top. The bags are tied previous to filling, and a valve may be discovered by careful inspection of any of the standard sacks used today. Every modern cement manufacturer employs a packing machine for filling sacks. As sacks are filled a conveyor belt running the entire length of the packing room unloads them within a few feet of the car, ready for shipment.

Building permits issued in Toronto during 1919 represented an expenditure of $19,819,436, as compared with $8,535,331 for 1918. There were 9,709 buildings erected, exceeding the 1918 figure by 5,356. The record includes: four apartments, $135,000; 2,692 brick front and roughcast dwellings, $603,210; 71 frame dwellings, $113,100; 38 factories, $1,959,563; 2,593 garages, $1,158,959; 22 offices, $148,450; 3 schools, $285,000; 235 stores, $1,598,550; 6 theatres, $701,000; 23 warehouses, $898,693.

The City of Montreal has appointed J. Emile Vanier, civil engineer, as its arbitrator in the case of the La Salle Bridge contracts.

Building Permits for November Greatly Exceed Those of a Year Ago

ACTIVITY in the building trades as indicated by the value of building permits in 35 cities showed a decrease during November as compared with the preceding month, the total value of building permits falling from $9,469,567 in October to $6,936,438 in November, a decrease of $2,533,129 or 26.8 per cent. New Brunswick and British Columbia were the only provinces to record considerable increases in this comparison.

As compared with the corresponding month in 1918, there was an increase of 190.6 per cent., the value for November, 1918, being $2,387,045. In this comparison all the provinces, except Nova Scotia, recorded substantial increases. A substantial increase in activity in the building trades during 1919 as compared with 1918 is indicated by the large increase in the value of the building permits issued, the preliminary figures for eleven months in 1919 being $71,757,564 as against $35,192,012 in 1918.

Of the large cities, Toronto, Edmonton and Vancouver recorded increases in November, both as compared with October, 1919, and with November, 1918. Montreal and Winnipeg showed declines in comparison with October of 1919 and increases over November, 1918.

Estimated Cost of Building Work as Indicated by Building Permits Issued in Thirty-five Cities

City	November, 1919	November, 1918	November, 1919, compared with November, 1918. Increase * Decrease †	
			Amount	Per cent.
Nova Scotia	**$244,795**	**$345,597**	† **$100,802**	† **29.17**
Halifax	224,210	326,907	† 102,697	† 31.41
Sydney	20,585	18,690	* 1,895	* 10.14
New Brunswick	**278.930**	**25.050**	* **253 880**	***1,013 40**
Moncton	52,430	22,550	* 29,880	* 132.51
St. John	226,500	2,500	* 224,000	*8,960.00
Quebec	**1,218,407**	**635,375**	* **583,032**	* **91.75**
Montreal-Maisonneuve	890,864	339,475	* 551,389	* 162.42
Quebec	171,378	69,050	* 102,328	* 148.19
Sherbrooke	5,000	10,000	† 5,000	† 50.00
Three Rivers	124,875	209,600	† 84,725	† 40.42
Westmount	26,290	7,250	* 19,040	* 262.62
Ontario	**4,123,791**	**1,132.664**	* **2,991,127**	* **264.98**
Brantford	194,945	129,945	* 65,000	* 50.02
Fort William	4,700	525	* 4,175	* 795.24
Guelph	20,325	5,830	* 14,495	* 248.63
Hamilton	525,140	356,000	* 169,140	* 47.51
Kingston	12,793	18,355	† 5,562	† 30.30
Kitchener	86,690	1,265	* 85,425	*6,752.96
London	109,960	110,690	† 730	† .66
Ottawa	264,550	41,600	* 222,950	* 535.94
Peterborough	4,940	2.532	* 2,408	* 95.10
Port Arthur	10,968	3,240	* 7,728	* 238.52
Stratford	10,805	1,153	* 9,652	* 837.12
St. Catharines	44,035	13,319	* 30,716	* 230.62
St. Thomas	6,610	9,025	† 2,415	† 26.76
Toronto	2,536,045	396,385	* 2,139,660	* 539.79
Windsor	291,285	42,800	* 248,485	* 580.57
Manitoba	**316,400**	**60,096**	* **256,304**	* **426.49**
Brandon	7,000	17,046	† 10,046	† 58.93
Winnipeg	309,400	43,050	* 266,350	* 618.70
Saskatchewan	**201,995**	**41,400**	* **160,595**	* **387.91**
Moose Jaw	8,200	3,200	* 5,000	* 156.25
Regina	173,359	29,850	* 143,500	* 480.74
Saskatoon	20,445	8,350	* 12,095	* 144.85
Alberta	**139,205**	**61,100**	* **78,105**	* **127.83**
Calgary	56,000	42,500	* 13,500	* 31.76
Edmonton	83,205	18,600	* 64,605	* 347.34
British Columbia	**412,915**	**85,763**	* **327,152**	* **381.46**
New Westminster	10,200	3,800	* 6,400	* 168.42
Vancouver	387,530	70,798	* 316,732	* 447.37
Victoria	15,185	11,165	* 4,020	* 36.01
Total—(35 Cities)	**$6,936,438**	**$2,387,045**	***$4,549,393**	* **190.59**

The dates of the Ottawa conference of the Association of Canadian Building and Construction Industries has been changed to February 2, 3 and 4.

Definitions in Connection With Asphalt

As Much Confusion Exists Regarding Terms Relating to Highway Work, Their Meanings are Discussed Herewith

SOME confusion exists in the popular mind, and to some extent among highway engineers, in connection with terms relating to highway work in which asphalt is used. To many, asphalt has always been surrounded with a certain sort of mystery that has been heightened rather than clarified by various scientific or highly technical reports which have been published from time to time. The Asphalt Association has published a brochure, the purpose of which is to set forth in plain language the meaning of certain terms in order to prevent their inadvertent misuse. In general, involved technical definitions will not be discussed, although a number of such have been widely adopted as standard.

The Terms Bitumen and Asphalt

The word **bitumen** was at one time applied only to certain naturally occurring materials of more or less solid consistency which were black and sticky, and which were usually associated with rock or clay deposits. In connection with highway work this term now includes that portion of petroleum asphalt and tar products, whether crude or refined, which is soluble in a liquid chemical substance known as carbon disulphide. The term **bituminous material** is even broader in its scope and is applied both to bitumen and materials containing bitumen. The amount of bitumen in a bituminous material, as determined by its solubility in carbon disulphide, is frequently reported as **total bitumen** in connection with laboratory tests.

Asphalt is a semi-solid or solid sticky product formed by the partial evaporation or distillation of certain petroleums. If the asphalt has been produced by natural agencies it is called **native asphalt** and often occurs mixed with considerable quantities of water, gas, vegetable matter and earth or clay. If, on the other hand, the asphalt is directly manufactured from petroleum, it is sometimes called **petroleum asphalt** and is practically pure bitumen. When asphalt occurs impregnating a porous rock such as sand stone or limestone, it is called **rock asphalt.** This material contains only a limited amount of bitumen and is mostly rock.

Terms Relating to the Preparation of Asphalt

The term **asphalt cement,** ("A. C.") is applied to an asphalt which is of suitable consistency for direct use in highway work. If the **asphalt** is too hard for direct use but is otherwise suitable it is called **refined asphalt** ("R. A."). When an **asphalt** is manufactured from petroleum it is usually made direct into an A. C., although it may, if desired, be turned out as R. A. Crude **native asphalt** is almost invariably subjected to a refining process in order to remove the vegetable and mineral impurities as completely as possible. The refined product is then an R. A. which may still contain an appreciable amount of impurities. Before use in highway work all R. A., whether produced from native asphalt or directly from petroleum, must be softened to suitable consistency by combining it with a flux. **Flux** or **flux oil** is a non-volatile liquid produced from petroleum by distilling off the lighter and more volatile constituents. It may be mixed with melted R. A. in proper proportions to form an absolutely homogeneous **fluxed asphalt** of A. C. of any desired consistency. The fluxing process is usually conducted at a paving plant in the manufacture of paving compositions.

Sometimes an A. C. of suitable consistency for a given purpose is thinned to fluid consistency with a volatile petroleum distillate such as gasoline. The resulting product is called **cut-back asphalt** and upon exposure will rapidly become an A. C. through evaporation of the light solvent. An A. C. may also be thinned to fluid consistency by the addition of water provided an emulsifying agent such as soap is present in the mixture. When combined with water in this manner the product is called **emulsified asphalt.** The term **liquid asphalt** is sometimes applied to a fluid petroleum product or road oil which is highly asphaltic in character and possesses the property of adhesiveness or stickiness to a marked degree. An **asphaltic petroleum** is one which contains a considerable amount of asphalt dissolved in the lighter oils present and from which asphalt may be readily manufactured by evaporation or distillation to remove these light oils. Certain asphaltic petroleums are quite similiar to cut-back asphalt, in which case they are sometimes called **malthas.**

Terms Relating to the Physical Properties of Asphalts

The **hardness** of an asphalt is expressed as penetration, which is a measure of the depth to which a standard needle will penetrate it at a standard temperature during a definite period of time when the needle is loaded with a known weight. Unless otherwise indicated, weight and time factors are understood to be 25 degrees Centigrade (77 degrees Fahrenheit), 100 grams, 5 seconds. The depth of penetration is expressed in units. Thus a 50 penetration asphalt is one in which the standard needle penetrates to a depth of 50 units. Asphalt of 100 penetration is a softer grade because under the same conditions of test the needle will penetrate it for a depth of 100 units. Thus the softer the asphalt the higher its penetration, and the harder the asphalt the lower its penetration becomes.

The **ductility** of an asphalt is expressed as a measure of the distance which a standard briquet of the asphalt will stretch without breaking, at a standard temperature, when the ends of the briquet are pulled apart at a definite rate of speed. The temperature is usually specified as 25 degrees Centigrade (77 degrees Fahrenheit) and the rate of speed is 5 centimetres per minute. Ductility is then expressed as the minimum number of centimetres which the test specimen will stretch without breaking. Thus a ductility of 40 means that the briquet will not break until pulled apart for a distance of 40 centimetres.

The **melting point** of an asphalt is that temperature at which it softens sufficiently to flow as determined by an arbitrary method. Upon being subjected to a rising temperature there is no critical point at which asphalt suddenly changes from a solid to a liquid, as it gradually becomes softer and softer. The melting point test is ordinarily made by first moulding the asphalt in a circular brass ring which is suspended under water beside a thermometer. A standard steel ball is placed upon the upper surface of the test specimen and the temperature of the water is then raised at a standard rate. The temperature at which the steel ball forces the asphalt one inch below the brass ring is expressed as the melting point. Other methods have also been devised which, for identically the same asphalt, will show a different melting point. It is therefore important that the exact method of testing be known in connection with any statement of the melting point of an asphalt.

The **flash point** of an asphalt is that temperature at which it evolves vapors which ignite upon contact with a flame. This temperature is and should be higher than any to which the asphalt should be heated during its application in highway work.

The **loss by volatilization** of an asphalt is the per-cent. by weight which it loses when a sample is heated and maintained at a temperature of 163 degrees Centigrade (325 degrees Fahrenheit) for a period of 5 hours under standard conditions of test.

Pavements and Foundations

Highways in which asphalt is used are almost invariably composed of two or more courses. The **upper or wearing course** is called the **pavement** provided it has a substantial thickness, usually of one or more inches. When asphalt is used in the superficial treatment of any pavements to produce, with a subsequent application of stone chips, sand, etc., a thin blanket course, such superficial course is called an **asphalt carpet** or **asphalt seal coat.**

The **bottom course** of a highway which is laid upon the sub-grade, is ordinarily called the **foundation** or **base** and if courses are placed between the foundation and pavement they are called **intermediate courses.** When sub-grade conditions are particularly bad a course is sometimes placed below what would ordinarily be considered the foundation, in which case it is termed a **sub-base.**

Asphalt pavements are laid upon a variety of foundations or intermediate courses which may or may not be of the same type as the pavement proper The most common types of foundation are broken stone or macadam foundation, the Telford foundation, the cement concrete foundation, and the bituminous concrete foundation. Asphalt pavements are frequently laid upon old pavements such as macadam, cement concrete, brick or stone block, in which case the old highway structure as it exists is usually referred to as foundation.

Classes of Asphalt Pavements

The **asphalt macadam** pavement is a broken stone pavement laid in a manner similiar to ordinary macadam; except that the broken stone of the wearing course is coated and filled with asphalt applied by the pouring or **penetration** method after the stone has been placed on the road. Such application may be made with hand pouring pots or by mechanical pressure distributors. No macadam pavement which has merely been surface treated with asphaltic road oil, cut-back asphalt, or asphalt emulsion should be called an asphalt macadam. Such indiscriminate use of the term is not only misleading but places a relatively high and permanent type of construction in the same class with waterbound macadam which is temporarily maintained by surface treatment.

An **asphalt concrete** pavement is one composed of a mixture of asphalt with broken stone, broken slag, or gravel and often with sand and mineral filler as well. The term **concrete** presupposes a mechanical mixture prepared before laying. When the aggregate of asphaltic concrete is composed of single commercial size of broken stone such as used in the wearing course of macadam, the resulting pavement has sometimes been erroneously referred to as asphalt macadam. Such practice should be discouraged as the asphalt macadam is always constructed by the penetration method. There are a number of patented pavements belonging to the asphaltic concrete class, such as "Bitulithic," "Warrenits," "Bitoslag," "Amieste," "Filbertine," etc. An unpatented pavement, known as the "Topeka," type, is an asphaltic concrete in which the individual particles of the mineral aggregate range in size from one-half inch in diameter to dust.

The **asphalt block** pavement is one constructed of blocks composed of a dense asphaltic concrete which has been subjected to heavy compression during the process of moulding. Such blocks are laid in regular courses as in the case of a brick pavement.

The **sheet-asphalt pavement** is composed of a mechanical mixture of asphalt with a carefully graded sand and a mineral filler such as limestone dust. The mixture is often called **sheet-asphalt topping** or **surface mixture** and is usually laid on an intermediate course of asphaltic concrete known as the **binder** or **binder course.** In some localities asphalt is mixed with local sand which does not meet the standard grading requirements for sheet asphalt. A pavement constructed of such a mixture is greately inferior to sheet asphalt and is usually called an **asphalt sand pavement.**

A **rock asphalt pavement** is one in which the wearing course is constructed of natural rock asphalt which is usually crushed or pulverized first and in which is sometimes incorporated additional asphalt or flux oil.

An **asphalt-earth** pavement is one composed of a mechanical mixture of asphalt with finely divided earthy material such as clay. The "National Pavement," which is patented, belongs to this class.

The term **asphalt seal coat** is often employed in connection with the use of asphalt in the surface treatment of asphalt macadam and certain asphaltic concrete pavements, either during or after construction. In such cases the asphalt serves to fill the surface voids in the pavement and when covered with stone chips, fine gravel or sand produces as asphalt carpet or mat which protects the underlying pavement.

Asphalt Fillers

Asphalt fillers are prepared for filling joints and cracks in brick, stone block and cement concrete pavements. There are three general types of asphalt filler.

The **poured joint filler** is a specially prepared asphalt which may be heated and poured into joints or cracks.

The **asphalt-grout filler** is a mechanical mixture of asphalt and fine sand which while hot may be poured over the pavement surface and broomed or squeegeed into the joints.

The **prepared joint filler** may consist either of specially prepared asphalt in the form of premoulded strips, which are inserted in the joints, or they may be premoulded mixtures of asphalt with such substances as limestone dust, silica or shoddy dust. Sometimes the filler strips are reinforced with fabric and sometimes they consist of one or more layers. Premoulded expansion joints reinforced or armored with metal are also manufactured.

Asphalts are quite different from tars, both in their physical and chemical properties. This fact should be clearly understood in order to prevent confusion in the common use of the word bituminous, which is applied to pavements and products which may contain either asphalt or tar. Thus a bituminous macadam pavement may be either an asphalt macadam or a tar macadam and a bituminous filler may be either an asphalt filler or a tar filler. Therefore, whenever it is desired to identify a product or pavement with the material used, the term bituminous should be replaced with the term asphalt or tar as the case may be.

Causes of Construction Labor's Instability

Several Contractors Give Their Opinions Regarding the Difficulties Confronting Users of Labor

IN a series of articles recording interviews with contractors, Engineering News-Record aims to analyze the instability of construction labor. Contractors have been having serious difficulties with construction labor and the settlement of the question is confronting all users of such labor. The analysis referred to is made with the idea of collecting suggestions as to corrective measures that may crystallize into some concrete plan for the solution of the problem. An abstract of these interviews is made herewith to indicate what is regarded as the cause of the instability that is besetting construction labor.

What is the matter with labor, specialized and common; union and non-union? What of its demands for higher wages and shorter hours? Are they equitable? Why does labor continue its radical requests? What can be done to stabilize the situation?

These and other pertinent questions revolve daily in the minds of contractors whose business demands employment of large bodies of skilled mechanics and common laborers. In the following conversation overheard while a passenger on a train passing through a small Hudson Valley town, William J. Morrissey, an executive of MacArthur Bros. Co., New York City, finds the best analysis of the laborer's state of mind. The train had stopped. Several laborer's of foreign extraction, came into the smoking car.

"How much are you getting?" queried the first laborer.

"Forty-five cents an hour," was the answer.

"I'm getting 56¼ cents," was the first laborer's comment.

"You're both pikers," came from a third. I'm getting 60 cents an hour, but I am no **common** laborer, I'm a **material handler.**"

Labor's Erroneous Ideas of Contractors' Profits

The laborer, according to views which Mr. Morrissey expressed has acquired a nervousness due to a condition existing during the war emergency. The war created a labor shortage. It also gave rise to a general, though, as Mr. Morrissey asserts, an erroneous idea that the contractor was making huge profits from war construction. The laborer's idea of a cost-plus-percentage, fixed fee, or sliding-scale contract was a gold mine for the contractor, and, jealous of the fancied immense profits he was aiding to secure for the contractor, the laborer set about to get his "slice." Such men in labor circles were known as "gold diggers." The results were the demands for increased wages. The labor shortage made him confident of being guaranteed steady employment, interrupted only by the few days of drifting from one job to another, in the hope that he might get more. He felt independent of any particular contractor for his livlihood, and this, coupled with the feeling that every time he raised a hand he was making large profits for the contractor, sowed the seed of the instability now generally felt.

Replying to the question as to whether labor received more wages now than it was reasonably entitled to, Mr. Morrissey said it was perfect equity for the wages to increase proportionately to the cost of living. In his opinion labor's increase had generally equalled the increased cost of living, but where the large employer of common labor is now losing is through the decreased efficiency of labor's efforts. The endless shifting about of common labor on wartime construction he believes has so impaired the efficiency of a laborer's effort that while the wages now paid approximate the same in actual purchasable value as pre-war wages, the value of his labor is way under pre-war efficiency. "If the cost of living has in the past few years advanced 75 per cent., then wages should have advanced accordingly," says Mr. Morrissey. "But it is obviously wrong that such an advance in living costs should bring labor 100 per cent. increase in wages, or that it should give but 50 per cent. efficient service with a 75 per cent. wage increase."

No Longer A Common Laborer.

Another thing the matter with labor is the fact that the common laborer no longer wishes to be thought of merely as a common laborer. Pre-war construction never knew such minute classification as now obtains. During the war a man who never did anything but handle a pick or shovel dropped that pick or shovel and went into some shipyard or to some other centre of construction where his otherwise common labor was rewarded with a title of classification. The minute he felt himself no longer a common laborer he considered his efforts worth greater compensation. So intesified became that system of labor classification that the common laborer almost ceased to exist. To use Mr. Morrissey's summation of the situation: "The minute you put a pair of rubber boots on a man he is no longer a laborer but a trench digger, sewer man, or what not, and as such demands more money."

Mr. Morrissey freely admits the equity of the principals of labor unionization, though there are union activities in the building trades for which he finds censure. Unions, seeing the labor shortage during the war, recruited their forces from all classes, the following incident serving to illustrate not an uncommon practice: A certain tailor was recommended to Mr. Morrissey for a job. His qualifications for building construction were a desire to take advantage of high wages, thereby bettering his financial condition, and a fancy that he could use a skilled workman's tools. His case came direct to Mr. Morrissey, who would not employ him because he was not a skilled mechanic. Had that tailor gone to an unprincipled union business agent, as unskilled workmen seeking better employment often did, paid his union initiation fee, bought himself a second-hand set of tools, he would probably have secured employment as a skilled mechanic. Such a business agent would tell the steward of the particular trade the situation, he would tell the foreman, who would tell the other workmen on the job to protect the newly acquired union "skilled" mechanic. Given such protection the tailor-mechanic would, nine times out of ten, have gone undiscovered, unless his work happened to be personally inspected by the superintendent. Such cases did happen where unions were not particular in picking skilled labor. The emergency was present. The demand for skilled building mechanics was great, and the end justified the means, in the union man's estimate of the situation. Because of the inclusion in their ranks of such unskilled "skilled" mechanics, the other workmen frequently adjusted their efforts to those of the newcomer, a fact that in no small measure contributed to the general fall in the efficiency of labor's efforts.

Laborer Not Amenable to Former Methods of Treatment.

Mr. Morrissey finds that, because of the labor shortage, the common laborer is no longer amenable to the treatment that he was best managed by years ago. He is a great believer in the old system of "the big boss" knowing all his workmen personally in so far as is possible, yet he is not now so sure that to go out onto a job, greeting this and that workman with a smile and calling his first name, is the best way to treat the workman. In some cases such treatment now makes the superintendent appear "soft." Neither do "gruff and hard" tactics secure best results. All of which is resolved into the assertion that in the treatment of workmen the superintendent has as diverse cases to study as he has workmen employed. Since most of his common labor is foreign the task is doubly severe, though increasingly interesting.

Admitting, then, the general instability of labor, its often excessive demands, the volatility of its temper, and its low percentage of efficiency, what remedial measures are possible? To this question Mr. Morrissey suggests that up to a certain point, granting that the standard local scale of wages is being paid, you can satisfy labor through the supply of comfortable living quarters, attractive meals and places in which to serve them, sanitary camps, and divers wholesome amusements. Extensive installation of such aids to comfort for the laborer is only possible on large jobs where the construction is to be carried on for a considerable length of time. Short jobs, though isolated, would not warrant large expense along such lines. Mr. Morrissey believes in the mental healing effect of comfortable sleeping quarters, proper bathing and sanitary facilities, good food well cooked, and wholesome entertainment. These can be provided within the confines of a large isolated job, so that the nearest village with its usual cheap amusement halls and saloons has no attraction for the laborer. If the laborer is a church member he usually finds a church of his denomination nearby, even in remote places. If the scale of wages paid is the standard local one, with the provisions of good quarters, clean, palatable food, sanitary conditions throughout the camp, comfortable mess halls, showers, pool and billiard halls, moving picture theatres, and reading and writing rooms, you have done about all you can toward stilling labor's restless spirit, thinks Mr. Morrissey.

Increased Production

Increased production by the greater use of labor saving machinery is regarded as a palliative by E. S. Skillin, vice-president of the Snare and Triest Co., New York.

If there were two men for every job instead of two jobs for every man, labor's restlessness would be materially quieted. The labor shortage is largely responsible for the difficulties in dealing with the various questions arising between employer and employees. Mr. Skillin thoroughly believes that many questions concerning the present labor situation would clear should there suddenly become available more men than jobs to put them on.

"There has been little or no immigration into the United States during the past five years," says Mr. Skillin. "Before that time an annual influx of approximately 300,000 foreigners gave us plenty of common labor. At the outbreak of the war many of these men were called to serve in the armies in their respective countries. The ranks of labor began to be depleted at that time, and when the United States entered the war many of our own men were mobilized. The shortage of labor was felt considerably, even while the war was in progress, but it is now becoming daily more acute, due to the departure from this country of men of foreign birth who are returning to their European homes. Emigration from this country now amounts approximately 10,000 per month, or a greater number than were counted as immigrants during the pre-war period."

With this decrease in the number of laborers and building-trades men available goes a marked fall in the efficiency of workmen in general.

Few Recruits in The Building Trades.

Another reason why there is such a labor shortage, particularly among building tradesmen, is due to the fact, says Mr. Skillin, that comparatively few young men, either of American or foreign parentage, are entering the building trades.

Contributing to the instability of labor is the uncertainty as to what living costs will be from month to month. Superintendents of the Snare and Triest Co., in talking with their men, have tried to impress upon them the dignity of the contracts with their employers. The contractor has indicated to the labor leader that when he cannot rely upon his contracts for labor the resulting conditions militate considerably against bidding for contract work. The reply to the contractor has always been the same, "If you will guarantee us that the cost of living will not increase during the life of the contract we will guarantee that no wage increase will be demanded." The guarantee naturally cannot be given, and the prices of labor and of materials produced by labor remain indeterminate.

Mr. Skillin does not believe in the efficacy of any scheme admitting the laborer to constant share in the profits tht he may aid his employer in securing. "Such a scheme may be applicable to organized industry, where personnel is a constant factor," states Mr. Skillin. "In contract work but a small percentage of your working forces ever approach a constant figure. With the labor turnover so great and with the adjustment of your working forces to each individual job, it it obvious that a system whereby the laborer shares in the profit or loss of a contract job is not feasible."

Several possibilities present themselves to Mr. Skillin as solutions of the shortage of labor which, if corrected, would, in his judgement, solve many incidental difficulties. In order to reverse the present condition, so that, instead of there being two jobs for each man, there will be two men for every job, there is but one alternative if the Federal restriction upon the importation of foreign labor continues—increased production..

Evidently, then, the shortage of labor demands extensive use of labor-saving machinery on construction work, in order to secure that increased production. The acomplishment of such a task is further hampered by labor's almost universal demand for shorter hours of employment.

Mr. Skillin's answer to the question, "What is the matter with labor?" is, therefore, "Decrease the necessity for it."

Sensational News Responsible for Unrest

At the door of the "unprincipled newspaper," which with sensational scare heads tells its story of strike, murder and riot, Harry Blenderman, assistant to the manager, Fred T. Ley Co., Inc., New York City, lays the responsibility for the fomentation of a great part of the present industrial disorder. Such papers, he says, so lacking in any moral responsibility, have invested the otherwise sane and industrious laborer with a belligerent spirit.

One strike, properly advertised, is, in the judgement of Mr. Blenderman, strong enough to damage materially all industry. One gang of laborers, seeing another gang making demands, decides that it will do the same. A succession of strikes and riots is inevitable therefore, when newspapers feature all lurid details. So continuously are his elemental emotions played upon that the laborer has been encouraged to assume a fighting attitude. "Once he has tasted blood he cannot be satisfied except with blood."

Through his taste for power coming to him as a result of the labor shortage created by the war; through the activities of a few conscienceless firebrands who have continually preached thee exploitation of labor by capital, and through the conscious or unconscious encouragement offered his excessive demands by a sensational press, the laborer has himself become conscienceless, and is fast losing all desire to share either industrial or social responsibility.

Intoxicated By Prosperity.

The laborer, then, "intoxicated by his prosperity," observes Mr. Blenderman, is actuated by a single motive—to get all he can out of his employer. The sane, industrious building mechanic of former years, possessed of the proper balance of public, private and industrial responsibility, has been relegated to the back ground. He has been superseded by the younger and irresponsible mechanic. This newer type shrinks at the suggestion of any scheme which will make him share in the lean as well as the fat construction cycles. His attitude takes into account neither the brains behind business organization nor the administrative ability underlying successful management.

Mr. Blendermen emphasizes the fact, expressed previously, that there is a decided shortage of construction labor. He heartily endorses the plan permitting restricted immigration. The need for foreign labor, he asserts, is urgent. But he offers corrective measures yet unmentioned. The first of these would be to purge the "yellow" press and to eliminate publication designed to propagate disorder and unrest through misstatement and poisonous insinuation. His second corrective suggestion is that the union laborer be made legally, individually responsible so that he will be forced to live up to contracts he signs for the supply of his labor.

Make Laborer Legally Responsible for Contract

Conditions now exist whereby demands made by labor in excess of the contract price must be borne by the contractor. Mr. Blendermen believes it possible to effect legislation whereby the laborer will be held as legally responsible when he signs his name to a labor contract as the contractor is legally responsible for agreements he enters into. Why such legislation has so far been avoided Mr. Blendermen explains by the fact that politicians generally, realizing from what sources come the greatest number of votes, are not anxious to do anything that will defeat their political desires.

That there is a shortage of labor, which threatens further to complicate matters should the amount of construction materially increase, contractors generally agree to. One thing to be avoided, states Mr. Blendermen, is contractors bidding against one another for different classes of labor. This state of affairs is liable to exist, he declares, in the event that the construction program materially increases, and in the event that the utmost in co-operation is not sought by the contractors.

Should the construction program increase to such an extent that it will force such a condition, Mr. Blendermen suggests a pro-rating of work over a stated period of time or a slight slowing up of all work. A slacking up in, or a cessation of, the construction program is not at all desired, but is accepted as an alternative in the event that contractors get to bidding against each other, thereby causing another sharp inclination upward in the price of construction labor.

No Fear of Unemployment.

One reason why labor is so hard to handle at present, a reason heretofore unmentioned, Mr. Blendermen says, is the fact that during the war building mechanics learned other trades to which they can turn their hands in the event that employers discharge them. The laborer is now so versatile that he has no fear of unemployment if locked out by his employer, or should he strike while working at his chosen trade. Mr Blendermen also states that though a close combination of the largest contractors might initiate some action whereby the building mechanic could be brought to a partial realization of his dependence upon organized industry, the percentage of small uncontrolled builders would be so large as seriously to militate against any plan conceived to return the labor to a reasonable basis.

Mr. Blendermen has the advantage of being able to look at the labor situation from both angles—that of the employee and of the employer—because of his former service as a union stone mason and his present responsibilities as a company executive. He has served his time in setting brick in the wall, and is unusually familiar with labor conditions from within the ranks of labor. He earnestly asserts that he has no quarrel with labor. On the contrary, he has its interest at heart though his patience is worn out by the increasingly unreasonable demands that a certain radical element enforces the majority to make. Viewing the situation, then, from the double viewpoint of the employer and former employee, he asserts that in many instances labor is demanding even more than it itself expects to gain.

Agreeing that corrective measures are to be found in welfare work, increase in the use of construction machinery, and restrictive immigration legislation, Mr. Blendermen adds his suggestions: Purge the newspapers; control construction, if necessary even to cessation of building; let contractors organizations show the greatest co-operation in dealing with the labor situation, and make the individual laborer legally responsible for wage contracts.

Administration to Blame For Infirm Labor Policy.

An administration supported in its treatment of industrial questions by academic theorists and predisposed, if not foresworn, to champion the various demands of organized labor, early in its incumbency planted the mustard seed of the present industrial and social turmoil, believes F. J. MacIsaac, member of the firm of Smith, Hauser & MacIsaac, New York City and past-president of the General Contractors Association. And not until a firmer hand is laid upon the throttle controlling social and industrial life can the county expect anything but abnormality in these matters.

A survey of the administration's acts, Mr. Isaac believes, will bear out his judgement that the administration possesses this inclination, and reasons ror such a belief he holds to be too self-evident to need either explanation or elaboration.

Since such industrial disorder does exist and since the question is one not for prophylactic treatment, but for therapeutic attention, he makes his diagnosis and finds industrial and social America suffering from a peculiar complication of ailments.

Industry is Underfed.

The first point is that industrial America is underfed; that is, the workmen to man its industrial plants and to do its construction work are inadequate in number to the needs of a healthy, growing nation.

As a partial relief for this disorder, immigration is proposed. However, Mr. MacIsaac is not certain that such a remedy should at this time be applied, because of the danger involved in further affecting the health of the patient with the poison of radicalism. Admitting that the shortage of labor is America's present constitutional difficulty, he turns to a consideration of other remedies. He finds that America's blood pressure is abnormal because of the universality of strikes, riots, and general social discontent. This ailment is traceable to the first failure of the administration to cope with the labor situation, and has been aggravated by the shortage of labor. Until different administrative methods are applied, then, and until something be done to overcome the constitutional disorder, there is little help offered the patient in correction of this trouble.

Some good has been done, Mr. MacIsaac believes, in the making of wage contracts between employers' associations and those representing the several building trades, such as the contracts entered into recently in Chicago and New York. However, he does not believe that such contralts will be binding under certain circumstances. He maintains that the law of supply and demand is the supreme power affecting construction and labor, and will operate as truly in construction work as in the regulation of the price of any household commodity. For instance, should legislation be passed whereby railroads, upon their return to private management, would be able to expend considerable amounts on road betterment, all common labor would easily be absorbed by them, paralyzing general construction work.

Then, again, if architects, builders and investors assume that the signing of contracts between the Building Trades Employers' Association and the Building Trades Council of New York City guarantees stability in wages and hours of employment, Mr. MacIsaac predicts the greatest building boom that New York City has ever seen. Inasmuch as the general building program is several years behind schedule, the sudden stability given wages, hours of employment, and the general labor situation, would result in the almost immediate release of extensive capital, particularly that for housing propositions.

In either case—if the railroads suddenly began extensive betterment programs, or if the general building industry were suddenly stabilized—contractors would immediately begin bidding against one another for the available supply of labor. In this competitive bidding contractors most capable of offering attractive wages in excess of those named in existing contracts, would secure the services of such labor. It is Mr. MacIsaac's statement that in Chicago now, only a few months after the signing by building trades employers and unions representing them of a three contract naming fixed wages and hours of employment, contractors have paid, for some classes of labor, from 10 to 25c an hour more than the scale specified in that contract. He also asserts that this bidding among contractors for labor exists in New York even now, though the condition, is not so serious at the present time as it threatens to be.

Plans and specifications for the proposed Mount Pleasant carline in Toronto have been completed and contracts are to be let within the next five or six weeks. The work will involve: (1) widening the pavement on St. Clair Ave. east of Yonge St. and installing new walks, besides permanent double tracks and pavement in the centre of the street, which has also to be graded; (2) grading Mount Pleasant Rd. and installing a temporary ballast line with overhead wires, etc.; (3) laying concrete walks on various sections of Mount Pleasant Rd.; (4) constructing certain bridges and trestles.

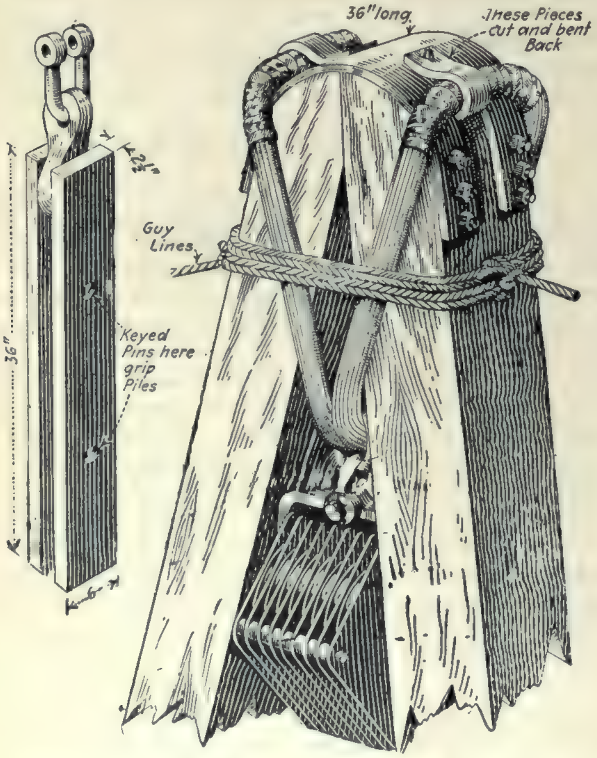
Hints for the Contractor

That May Save Him Time and Money—We Will Pay for All Accepted Items—Send One In

A-Frame with 15-Part Line Used for Pulling Steel Sheet Piles

STEEL sheet piles of the Lackawanna type are being pulled from about an average 40-ft. penetration with a specially devised A-frame rig, on the Queenston-Chippawa power canal of the Ontario Hydro-electric Power Commission. One of the bridges here is to carry an interurban electric railway across the canal, but it was built inside a sheeted excavation before the canal was dug. Now that the bridge is finished, the piles are being pulled before the canal has been dug up to the bridge walls.

The rig, as described in Engineering News-Record, comprises a heavy A-frame held by guy lines in slightly inclined position over the piles to be pulled, and carrying from the specially designed headframe the two-block 16-part line, at the bottom block of which is attached the pile-pulling grip. The frame is made up by 12 x 14-in. sticks heavily braced at the bottom and about 10 ft. from the bottom. The headpiece is a 6 x 1-in. steel plate bent over the curved top, as shown in the sketch herewith, and with interior loops made by cutting the plate as shown in the sketch and bending over and riveting down on the top. In these loops are hung wrapped cables which carry the top blocks. Just below the top band the guy lines are wound three or four times around the frame.



Details of A-frame pile puller in Niagara Falls power canal

The superintendent in charge of the job states that the rig would be more effective if the frame were more thoroughly braced, both with crossbraces and with a heavy wedge block in the crotch, and also that there should be hardwood blocks tacked onto the outside of the frame sticks underneath the guy-line binding.

In the first efforts to pull, an ordinary clevis was used with a pin through a hole cut by a gas flame in the top of the sheet pile. This soon pulled out the pile web, so the grip shown in the accompanying sketch was devised. This consists of two 3-ft. plates 6 in. wide, hanging from the lower block, with two 2½-in. holes through which the pile is gripped by keyed pins passing also through holes cut by a gas flame in the top of the pile to be pulled. This jaw gives a long, frictional grip on the pile; this has proved very effective.

The work is in charge of J. B. Goodwin, who is works engineer, with A. C. D. Blanchard, the chief field engineer.

Concrete Highway Grade Crossings

MAINTENANCE of ordinary highway grade crossings is an item of considerable and increasing expense. Most of this maintenance expense is due to loosening and destruction of the planks by traffic, the necessity of replacing and respiking planks to the ties, and the decay resulting from the contact of the wood planks and ties where they are subject to alternative wetting and drying. In view of the present high cost of lumber and labor, any type of construction which will reduce this expense is highly desirable.

Precast concrete slabs or planks, or cast-in-place monolithic concrete, offers a remedy. By replacing the wood planks with precast concrete the destruction of ties due to respiking and decay is practically eliminated and the cost of renewals is greatly reduced. Monolithic concrete crossings save the total cost of renewing crossing planks, ties and spikes, as well as the labor involved in repair of the wood plank type of crossing. Either the precast or monolithic concrete types will not only greatly reduce renewal and maintenance expense, but will also reduce interference with traffic and accident liability since the concrete itself will not require replacement or repairs over long periods of use.

Designs of some types of concrete crossings which have already been in successful use for some years are here shown.

The precast slab shown in Figure 1 provides for the use of precast concrete slabs laid directly on sawed track ties or on strips nailed to the ties. The only preparation of the track to receive the slabs consists in tamping the ties thoroughly and, if strips are required, nailing these to the ties. Experience has demonstrated that the weight of the slabs is sufficient to hold them in place, but where it is thought necessary they may be anchored by some means of screw bolts passing through malleable cast iron sockets provided for this purpose, as shown on Figure 2. The slabs are reinforced with steel bars or mesh and are provided with metal protection at the edges and with metal handling sockets to facilitate placing or removing slabs.

In railroad crossings at a manufacturing plant in Buffington, Ind., the slabs are reinforced with ⅜-inch round steel bars. These bars should be spaced not more than 6 inches apart and should be used at both top and bottom of the slab.

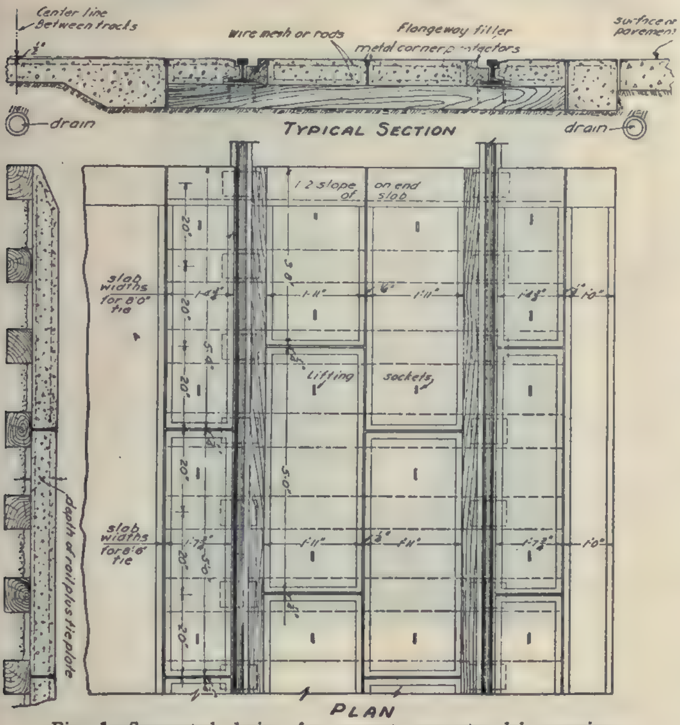


Fig. 1—Suggested design for precast concrete slab crossing

The precast plank type has been in successful use for several years. This type replaces the wood planking with planks made of concrete. The concrete planks are about 9 inches wide and six to eight feet long, and the thickness is the same as the rail depth. They are reinforced with wire mesh, expanded metal, or bars. If mesh or expanded metal is used, the heavier metal should extend lengthwise in the plank. Bars should be ⅜-inch rods and should be placed at each corner of the plank about 1¼ inches from the face.

Before the planks are placed the ties are thoroughly tamped to a firm bearing and sand or cinders tamped between them to furnish uniform support for the planks. These crossings present a much better appearance than the wood plank crossing commonly used, and are not subject to decay and subsequent high cost of maintenance.

The solid or cast-in-place concrete type is shown in Figure 3 and replaces not only the usual crossing planks, but ballast and ties as well. In this type the concrete is deposited in place except for that portion outside the rails which consists of precast slabs provided with sockets to make removal of the slabs easy when rail renewals are necessary. Gutters are provided for draining the water from around the rail.

The concrete should be mixed in the proportions of 1 part cement, 2 parts sand and 3 parts stone or pebbles. Care should be taken to secure clean aggregates and the pebbles or crushed stone should be hard and durable. The concrete should be cured by covering with moist sand or earth and kept moist for about ten days in order to secure maximum strength and durability.

A supply of sand and pebbles or stone for the solid or cast-in-place crossing is often available near the crossing. The slabs for the precast types can be manufactured at points convenient to the supply of aggregates. Common labor, under competent supervision, is all that is necessary for doing the work and the planks or slabs may be cast during the winter or rainy seasons when maintenance men would otherwise be idle.

It is estimated that the yearly saving in maintenance effected by the concrete slab or concrete plank types will pay for their installation in two years and that the saving in maintenance effected by the monolithic type shown in Figure 3 will pay for its installation in about three years.

The advantages that may be expected from the use of concrete crossings instead of the usual type are enumerated as follows in a bulletin issued by the Portland Cement Association.

1. Saving in maintenance and renewals of crossings sufficient to equal the cost of installing concrete in from two to three years.

2. Utilization of labor during the winter season in precasting slabs or planks, thus retaining it in profitable employment and making it available for the maintenance season.

3. Reasonable first cost.

4. Less damage to track ties because spiking is not required.

5. Less interference with traffic on both railways and highways and less liability to accident because of freedom from presence of repair and renewal gangs and from torn-up condition of crossing.

6. Better appearance.

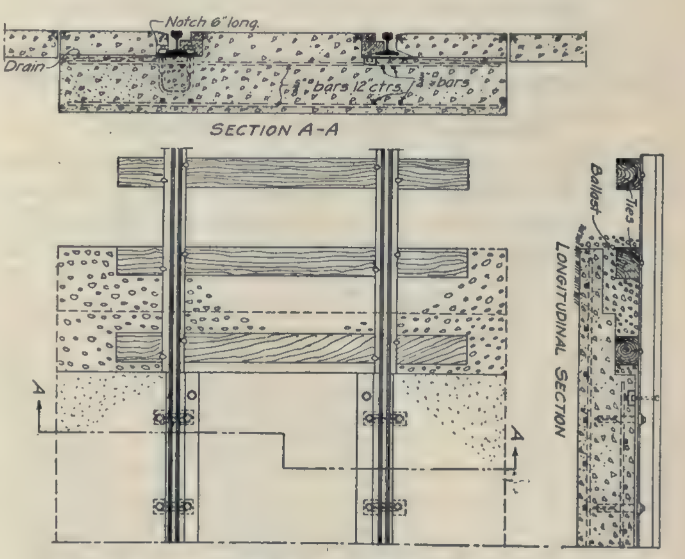


Fig. 2—Suggested design for solid concrete crossing, obviating the use of ties and ballast

The dates of the Ottawa conference of the Association of Canadian Building and Construction Industries has been changed to February 2, 3 and 4.

Canada's Contractors—T. R. Wright

Mr. T. R. Wright, of London, Ont., Secretary of the Provincial Builders' and Supply Association of Ontario, is one of the old-hands at the building game. He was born in 1856, in the Township of Kitley, Leeds County, Ont. At the age of seventeen he went to Smith's Falls to learn the trade of carriage building, which he followed for nine years. In the spring of 1882, he went to Winnipeg, then a city of 15,000, where he worked as carpenter. After remaining there for two years, he went to Minneapolis, where he was employed in the cabinet shop of the Chicago, Milwaukee & St. Paul Ry. Returning to Canada two years later, he entered the employ of the G. T. R. in the Coach Department, at London. In March 1896, he went into the building business in partnership with A. J. Humphrey, the firm's name being Humphrey and Wright. This firm built the London Street Railway office and car barns, when that system was changed from horse to electrical operation. Other buildings they erected were the Chelsea school and Presbyterian Church at London Junction, the Methodist Church at Glendale and the Pathological Institute for the London Medical School. Eight years after the formation of the partnership, Mr. Humphrey died, and the business has since been carried on by Mr. Wright.

Mr. Wright has been a member of the London Builders' Exchange for over 20 years. He was its President for two years. When the Provincial Builders' & Supply Association was formed, he was appointed one of the Board of Directors. He also held the office of president of that organization for two years, and when Mr. Coon resigned as secretary, he was appointed to fill the vacancy. He has always taken a deep interest in the building industry of the Province, and as secretary of the Provincial Association has contributed much earnest effort toward raising its status and increasing its usefulness.

Mr. T. R. Wright

Building Permits in Montreal

Permits for the erection of over ten million dollars' worth of buildings have been issued in Montreal during the past year. This constitutes a record, and is an indication that the growth of Montreal is proceeding at a rapid rate. The figures for the different months are as follows:

	Permits	Value
January	38	$ 60,154
February	78	151,740
March	102	228,208
April	238	446,740
May	272	1,269,435
June	204	731,417
July	270	1,484,999
August	239	1,541,243
September	223	1,050,476
October	238	1,519,992
November	155	890,854
December	66	658,401
Total	2,133	$10,033,901

Personal

Sir Wm. Hearst, late Premier of Ontario, is recommended for appointment to the International Joint Commission, succeeding Hon. P. B. Mignault, K.C., who was recently named a judge of the Supreme Court of Canada.

Mr. Ray R. Knight, M.E.I.C., has been appointed Toronto manager and engineer representative of Francis Hankin & Co., Ltd., Montreal. He has recently been chief engineer of the Canadian Incinerator and Furnace Co., Ltd., Toronto.

Mr. John A. Wilson, of Vancouver, has been appointed acting inspector of dykes, under the British Columbia Dept. of Public Works, with jurisdiction over the lower Fraser district. Mr. Wilson served with an infantry battalion and afterwards with the Royal Engineers during the war.

Mr. A. C. Mitchell has been promoted to the position of assistant-manager of the staff of the Toronto Harbor Commission. Mr. F. Rockwell becomes superintendent of construction, and Mr. N. R. Nichol, engineer of construction.

Mr. A. D. Swan, of Montreal, consulting engineer on the Vancouver Harbor development, is now in that city, where he will supervise the construction of the new pier which is to be built as part of Vancouver's harbor development.

Mr. Allan Latornell succeeds Mr. W. R. Worthington as engineer in charge of the sewer section of the Department of Works of the City of Toronto. Mr. Latornell is a graduate of the University of Toronto in engineering, and has been connected with the Toronto sewer section in various capacities since 1907. The resignation of Mr. Worthington was noted in the Contract Record of Dec. 10.

Mr. Andrew H. Harkness, consulting engineer, of Toronto, and formerly of the firm of Harkness and Oxley, has entered into partnership with Messrs. T. L. Loudon and C. S. L. Hertzberg, under the name of Harkness, Loudon and Hertzberg. Messrs. Loudon and Hertzberg were formerly associated with the firm of James, Loudon and Hertzberg. Mr. Harkness is a graduate of the School of Practical Science, of Toronto, and is widely experienced in structural engineering. For the past year he has been chairman of the Toronto Branch of the E. I. C.

Mr. F. R. Gray, city engineer of Hamilton, Ont., has resigned that position to enter business life.

Mainly Constructional

East and West—From Coast to Coast

The year 1919 was a record building year in Sarnia, Ont., the building permit figures being 424, valued at $646,956.

Port Arthur's building permits for the year 1919 represent a total of $1,708,845, as compared with $610,527 for 1918.

In Moose Jaw, Sask., for the past year the building permits show a total value of $590,865, as compared with $567,645 in 1918.

Quebec City's building permit figures for 1919 are 682 permits, at a value of $2,133,716, as compared with 538 permits in 1918 at a value of $904,375.

Reports are current that Handley Page, Ltd., the British firm airplane manufacturers, are planning to locate a branch factory in Canada.

It is stated that Toronto's new Union Station will be ready for occupation on or about May 1, if labor and material delivery troubles do not interfere.

There were 234 building permits issued in Niagara Falls, Ont., during 1919, at a value of $876,889, as compared with 105 permits in 1918, at a value of $356,716.

Building permits issued in Vancouver last year show a large increase over 1918. The figures are, respectively, 1,222 permits valued at $2,266,639, and 829 valued at $1,440,384.

The question of a greater water scheme for southern Saskatchewan through the use of a pipe line from the Saskatchewan River is to be discussed in the Provincial Legislature.

Regina's building permit figures for 1919 exceed those for any year since 1914. The total for last year was $1,696,520, as compared with $1,006,000 for 1918. In 1914 the total was $1,765,875.

A new record in value of building permits has been set in Brantford, Ont., during the past year. The total reached is $1,173,580, which slightly exceeds the figure reached in 1912, which was $1,168,105.

It is announced that the Canada Cement Co. will shortly resume the manufacture of cement at their Lakefield plant, which was shut down shortly after the outbreak of war.

The value of building permits issued in St. Thomas, Ont., during 1919 reached a total of $250,000, which exceeds the totals for each of the three years previous by $100,000 or more.

Building permits isued in Galt, Ont., during 1919 reached a total of 125, valued at $332,101, which is about double last year's figure. Forty-four new houses were built at a cost of $90,000.

A million-dollar hotel is projected in Windsor, Ont. A hotel company has been organized to carry on the undertaking and already, it is said, half of the required capital has been subscribed.

The Halifax Housing Co., Ltd., has had plans prepared for the construction of forty houses to be erected in Halifax, N.S., on the Ardmore property, North and Oxford streets. Tenders have been called.

Building permits issued in Regina, Sask., during 1919, reached an appoimate value of $1,600,000, much the largest figure of any year since the outbreak of war, and exceeding the 1918 figure by more than half a million.

It is announced that the firm of Cluett-Peabody will invest $150,000 in a new plant. A new factory will be built in Sherbrooke, Que., a subsidiary plant is being built at St. Johns, and a third site has been secured in the north-east section of Montreal.

Mr. Geoffrey Porter, Hydro-electric engineer, of the Dominion Government, has been visiting points in the Okanagan district, in British Columbia, investigating the situation with regard to the possibility of power development at Shuswap Falls.

The value of the construction work carried out by the Dominion Steel Corporation in Cape Breton during the past year is stated to be about $15,000,000. The work undertaken includes the erection of a plate mill and power house, extending the benzol plant, increasing the capacity of reservoirs and alterations to the Sydney and Louisburg Railway lines.

That the Welland Canal contracts will come up for consideration again shortly is stated in political circles. During the war the works were suspended. They were then resumed for a short time on a cost-plus basis. It has now to be decided whether the balance of the work will be let on a lump sum or percentage basis. There are four sections upon which nothing has yet been done.

During the month of December there were 44 building building permits issued in Hamilton, Ont., representing an outlay of $180,750. Eleven of these permits were for brick dwellings, costing $32,500, nine were for frame dwellings costing $12,300; two for brick stores, costing $8,000; three for factories and additions costing $115,000; thirteen for garages, and six for alterations and additions.

Additions to Winnipeg's water main system costing $95,700 will be started as soon as the season opens up. Six new mains are to be installed to take care of the extra volume from the McPhillips Street pumping station, as a result of the closing of three stations, following the completion of the Shoal Lake aqueduct. Alterations are recommended for the McPhillips station, involving an expenditure of $22,000, which will include the installation of a new high pressure pump with a capacity of 10,000.000 gallons per day. Alterations at the high pressure station are also proposed, and the laying of a new main across the Assiniboine river, near the centre gate.

The Dominion Canning Co. are building a new plant at Strathroy, Ont. The contract was let in two parts: Mr. W. I. Taylor, of Woodstock, was awarded the contract to build the warehouse, which was completed last October, and the Green Lumber Co. of St. Thomas are erecting the factory building. This latter contract was commenced on Oct. 15, and is to be ready for the installation of the machinery by March. The buildings are three storeys high, with basements, built of concrete and red press bricks, with Barrett Specification roof. The total cost of the construction work will be $150,000. The company is also erecting a building, 60 x 160 ft. in plan, at Herwood, Ont., by day labor. Still further expansion is planned by the company through the enlargement of their Bellriver factory. Thomas Wooster of Aylmer, Ont., is architect for this work.

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks, Sewerage and Roadways

Amherstburg, Ont.
Town plans construction of pavement on Front Rd. Mayor, Dr. Park.

Bancroft, Ont.
By-law passed authorizing construction of concrete sidewalks for Town; cost, $5,000. Clerk, T. F. Kavanagh.

Chatham, Ont.
Tenders will be called for dredging and improving drain for East Tilbury Township. Engineer, Geo. A .McCubbin, Chatham.

Dresden, Ont.
By-law passed authorizing construction of waterworks system, mains and tanks costing $16,000 for Town. Clerk, J. T. Bridgewater. Prices wanted on elevated steel tank, two pumps, motor and gasoline engine.

Elm Creek, Man.
By-law passed for construction of roads to cost $186,000 for Municipality of Grey; clerk, O. T. Soole, Elm Creek. Tenders will be called in April.

Exeter, Ont.
Town contemplates drainage work. Will shortly consider purchase of tile. Chairman, Louis Day.

Kincardine, Ont.
By-law passed authorizing construction of extension to waterworks for Town; cost, $9,000. Clerk, John H. Scougall.

Lucan, Ont.
Town plans to construct roadway 16 ft. wide; cost, $8,000. Clerk, L. Gibson.

Lunenburg, N. S.
Town plans to construct permanent streets and sidewalks. Mayor, William Duff.

Milverton, Ont.
By-law passed authorizing construction of waterworks system costing $50,000 for Town; clerk, W. D. Weir, Milverton. Engineers, E. A. James Co., Excelsior Life Bldg., Toronto.

Montreal, Que.
Federal Zinc & Lead Co., 120 St. James St., Montreal, are applying to Provincial Gov't. for permission to construct road from Cacetapedia to Berry Mountain, Que.

Ottawa, Ont.
Ottawa Improvement Commission, 53 Queen St., plan Echo Drive from Bank to Nicholas St. Chairman, Sir Henry Egan; engineer, Alex. Stuart; clerk, Wm. Kearns.

Ridgetown, Ont.
Town will shortly consider paving program for 1920. Clerk, D. Cochrane.

Sarnia, Ont.
By-law passed authorizing purchase of asphalt paving plant for City. Clerk, Jas. D. Stewart.

Tiverton, Ont.
Bruce County Council plans to make road improvements; cost, $44,000. Chairman, F. E. Coombe, Kincardine.

Toronto, Ont.
City plans extension of Terauley St.; cost, $1,000,000. Mayor, T. L. Church; works commissioner, R. C. Harris.

Tupperville, Ont.
Townships of Dover & Chatham plan to construct Little Bear Creek Drain; cost, $150,000. Clerk, A. McArthur, Tupperville. Work includes 19 miles of dredging and several bridges. Tenders will be called shortly.

Waterford, Ont.
Town plans to construct permanent roadway. Reeve, Dr. R. H. Teeter.

Woodstock, Ont.
By-law passed authorizing construction of sewer and activated sludge to cost $110,000 for City. Clerk, John Morrison.

CONTRACTS AWARDED

Winnipeg, Man.
Carter-Halls-Aldinger Co., Union Bank Bldg., have general contract for roads and sidewalks for Dominion Govt.

Railroads, Bridges and Wharves

Brantford, Ont.
By-law passed authorizing construction of bridge costing $211,000 for City. Engineer, T. Harry Jones.

Charleswood, Man.
By-law passed authorizing construction of bridge costing $38,000 for Municipality of Charleswood and Assiniboia. Secy.-treas., A. B. Blakely, Charleswood.

Digby, N. S.
Dominion Atlantic Rly., Kentville, N. S., plans to erect station. General Manager, Geo. Graham.

Fredericton Junction, N. B.
C. P. Rly., head office, Montreal, Que., plan to erect station, brick and stone construction, to cost $50,000.

Guelph, Ont.
Plans are in progress for bridge for County of Wellington and City of Guelph; clerk for Guelph, T. J. Moore. Engineers, Bowman & Connor, 34 Victoria St. Tenders will be called the end of Jan.

Hamilton, Ont.
By-law passed authorizing Ontario Hydro Commission, University Ave., Toronto, to construct hydro radial connecting Hamilton, Galt, Kitchener and Elmira, with a branch line from Galt to Guelph.

Kentville, N. S.
Dominion Atlantic Rly., Kentville, plan to erect railroad shops. General Manager, Geo. A. Graham.

Kinburn, Ont.
Fitzroy Township plans to construct bridge. Clerk, Wm. Boyles, Kinburn.

Louiseville, Ont.
New tenders will be called about Feb. 1st for extension to steel bridge and repairs to west piers for City; cost, $8,000. Engineer, Ivan Vallee, Public Works Dept., Parl. Bldgs., Quebec; clerk, L. D. Caron, Louiseville.

Port Credit, Ont.
Ontario Hydro Commission, University Ave., Toronto, will start work on hydro radial line from Port Credit to St. Catharines.

Sandwich, Ont.
By-law passed authorizing Ontario Hydro Commission, University Ave., Toronto, to take over from the Detroit United Rly. electric railway connecting Sandwich, Windsor and Amherstburg.

Simcoe, Ont.
By-law passed authorizing construction of five bridges for Town; cost, $70,000. Clerk, W. C. McCall.

St. Louis De France, Que.
C. P. Rly., head office, Montreal, plan to construct railroad from Piles Junction to S. H. Giroux Lime Quarry (five miles); cost, $125,000. Supt., Mr. T. Lavoie, Three Rivers; engineer, Mr. Harper, Montreal.

Toronto, Ont.
Tenders received by T. L. Church, City Hall, until Jan. 17th for construction and equipment of Mt. Pleasant car line; cost, $750,000. Plans with Works Dept., Room 313, City Hall.

Vancouver, B. C.
Vancouver Harbor Bd. will have plans for first unit of Harbor Improvement scheme completed at once and will award contracts as quickly as possible. Total cost, $5,000,000. Secy., Harvey, Major A. R. McKenzie, member of Bd.; consulting engineer, A. D. Swan, Montreal.

Public Buildings, Churches and Schools

Brantford, Ont.
By-laws passed authorizing the following: alteration of building for isolation hospital and nurses' home to cost $87,000, also construction of extension to general hospital at cost of $78,000 for Brantford General Hospital Board; construction of staff residence costing $20,000 for Brant Sanitarium Bd. City Clerk, H. F. Leonard.

Chatham, Ont.
S. G. Kinsey, architect, Eberts Blk., Fifth St., Chatham, is preparing plans for Church to be erected at Chatham Township for Presbyterian Congregation.

Crinan, Ont.
School Bd. plans to erect school costing $7,000. Inspector, J. A. Taylor.

Drumheller, Alta.
Drumheller Public School Bd. plans to erect school. Address secretary.

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A.C.B.C.I. Conference Will Mean Much for the Industry's Future

THE Conference of the Association of Canadian Building and Construction Industries, to be held at the Chateau Laurier, Ottawa, on Monday, Tuesday and Wednesday, Feb. 2-3-4, is an event of the greatest importance to the contractors of Canada. If successful, it will result in the completion of an effective organization which will provide the machinery for building up the status, the influence and the prosperity of the great industry to which they belong. If a failure, it will involve a large and unjustifiable waste of time, energy and money. But there can be no question of failure if the construction men of this Dominion will come together in a spirit of co-operation and prepared to act. It is action that counts. Plans and specifications are only valuable when they are worked into a building, and so discussion is of no avail until it results in definite action. We want—not plans, nor drawings, nor specifications—but a complete plant—in operation. And that's the project that has to be carried out at the Conference, which means that men have to get on the job and work.

General Contractors Must Get Together to Safeguard Their Interests

THE general contractor, though a comparatively recent arrival on the construction field, has come to be generally considered the most important factor in the industry. He filled a want that had been keenly felt for many years—that of a co-ordinating organization to bring about co-operation and synchronism in the operations of all the trades engaged on a construction undertaking. He filled another want, much to the satisfaction of the architect, by providing a pair of shoulders upon which the burden of complete responsibility might be placed. The owner, too, was not slow to realize the advantage of having a "goat," financially liable for any defects in his building or for any delay in its completion. Hence the general contractor was welcomed with open arms, and as to the "warmth" of his subsequent treatment, not many contractors will disagree.

However, the general contractor is here to stay. He is filling an important place in the development of industry, and the general contracting business itself has developed with surprising rapidity. But despite its continued growth in Canada and the many interests which Canadian general contractors have in common, it has as yet gained little or no homogeneity as an industry. In good times Canadian contractors have made money, because it was almost impossible to do otherwise, such was the demand for the services they could render; in bad times, they have cut each others' throats; at all times they have been "used" by the architect and the owner. There has, as a matter of fact, been no stability in the business. "Mushroom" concerns have sprung up overnight in times of prosperity when general contracting appeared to be a very lucrative proposition, only to arrive in the bankruptcy courts as soon as the demand slackened.

The business has, in the past, been characterized by recklessness, and recklessness produces graft, for it is human nature for a man to try and save himself by any means when he is being forced to the wall. The status of the whole industry has been lowered as a result, and legitimate general contractors who are seeking to run their business on sound principles have suffered with the rest. Some few of them have been making their grievances known, but most of them have been taking it stoically, as if there were no redress possible. Up to the present, in Canada, they do not appear to have realized, as a body of business men, that there is any means by which these unfavorable conditions can be combatted and such recognition obtained for contracting, as it deserves as a pioneer industry in national commercial development. But there is a weapon which general contractors can forge for themselves and use against these inimical conditions. That is the weapon of organization. And there is munition, with which they can disperse many of their industry's foes. That munition is propaganda. Here is the burden of the whole matter. The general contractors of Canada must get together. They must organize; they must co-operate; they must reach an understanding on ethical principles of doing business; they must be strong enough to hold labor to its agreements and to deal with delinquent members in their own ranks; they must seek to establish some uniformity of operating conditions, at least locally.

At the present time owing to the fact that the general contractors in most localities are simply "ganging their ain gait," the wage rate has been more uncertain than the weather. In an interview with a representative of the Contract Record recently, Mr. Holmes, of Archibald & Holmes, Toronto, laid emphasis on this point. The trouble most frequently arose, he said, where a contractor was working on a cost-plus job and the owner wanted it completed in a hurry. If the owner decided the work was not progressing fast enough to suit him, he would urge the contractor to get more men and would instruct him to raise the wage rate, perhaps 10 cents an hour, in order to do so. If the contractor followed the suggestion and increased the wages—as very often he would, thus keeping on friendly terms with the owner, and putting money in his own pocket—the result was that the other contractors in the locality had to grant an equal increase in order to hold their men, though most of them would be working on a lump-sum contract, for which they had figured on the lower rate. Mr. Holmes was very strongly of the opinion that the contractors should get together and bind themselves not to make any change in the wage rate during the season, unless by mutual consent. This would be to the advantage of all, as the raising of wages did not increase the number of workmen by a single man, but simply disorganized the business for the whole trade.

This is one specific condition which Canadian contractors require organization to remove. There is another almost ludicrous situation, in which the general contractors are making themselves the "goats." Some firms of architects, when conditions are favorable, are actually going into the general contracting business, with the help of the general contractors themselves. These firms call for unit prices from the general contractors and also call bids from the sub-contractors. With all these figures before them which have been prepared at considerable expense, they proceed to make up a conglomerate bid, picking out the lowest figures on each trade, and get some general contractor in as a sub-contractor, with the provision that his plant shall be available for use on the job as long as required. The net result is that after the general contractors have done his estimating and figuring for him, the architect, who has but a small organization to maintain and little or no financial responsibility, undertakes the general contract himself and gets credit from the owner for saving the general contractor's profit on the work.

Who can blame the architect or the owner if they can get away with it? As long as the general contractors will submit them unit bids, free of charge, there is no reason why they should not accept them. But it is time the general contractors woke up to their own interests and refused to allow the architect to use their cost-keeping organization in this way. Another point which they could settle if they got together and organized!

The time for organization is right now. Within the next few weeks, the convention of the Association of Canadian Building and Construction Industries at Ottawa will give the contractors the opportunity they need. Let them get together at that time and form their own organization, as a branch of the A.C.B.C.I., or in affiliation with it. There is this point to remember, that local associations in the various cities and towns of Canada must be the basis of their organization. These local associations should send representatives to compose provincial executives, and the provincial executives can in turn elect members to a Dominion council. Such provincial and Dominion bodies are very desirable, for there are very many problems which affect the contractors of Canada as a whole, while others affect the individual provinces. But when all is said and done, the local organization is the most important; it can do the most work, and the average general contractor will find more benefit from it than from the so-called "parent" organizations. Let the general contractors start to build there, from the bottom up, and let them draw up their plans at the A.C.B.C.I. convention in Ottawa, Feb. 2-3-4.

Local Exchange is Proper Basis of Organization in Building Industry

At the coming Ottawa conference of the Association of Canadian Building and Construction Industries, the dates of which have been changed to Feb. 2-3-4—as previously announced—it is expected that there will be a very representative gathering of contractors in every line of business, building supply men, manufacturers of structural materials, and others connected with the industry, from all parts of the country. The Association is as yet only in its preliminary shape—in contracting terms, sketch plans have been drawn and the material is on the ground, but there lies ahead the task of drawing up the detailed plans and completing the structure. The construction men who attend the conference must come prepared to carry out this work. Vague and hazy ideas will clog the discussion and delay the reaching of conclusions. Every man should have a "solitaire" session beforehand, weigh the matter pro and con, and come to the conference with definite ideas as to the form the organization should take, its objects and its executive machinery. He will thus have a criterion with which to compare the proposals brought forward by others, and a criterion is as valuable in working out a scheme of organization, as a plumb line is in erecting a building.

The plan which the Contract Record has been advocating is the "local-unit" or "district" scheme of organization. In this scheme the local exchange is the basis of the whole organization. That is where the interest of nearly every contractor centres—in his own exchange. Through it he can obtain more direct and more apparent benefits than through any broader association, but that does not mean that the work of organization should stop there. We cannot build up a homogeneous and influential industry without a Dominion-wide organization. Canada, however, is a big country and from a local unit to a Federal Council is too long a step. There must be intermediate bodies to hold together the district exchanges, else they will fall apart, and the logical division of the Dominion for the purposes of organization along these lines is, we believe, by provinces. That there is valuable and important work for a provincial executive to do is apparent, inasmuch as there are

Canada's Engineers—J. B. Carswell

Some ten years ago Mr. John B. Carswell arrived in Canada from Scotland, and took up a position in the engineering department of the Grand Trunk Railway in Montreal. In Scotland he had spent seven years training as a civil engineer as a pupil with J. B. Brodie, a well-known consulting engineer in Glasgow. His apprenticeship was spent on the installation of water works and drainage schemes, and on dock work on the west coast of Scotland. After his apprenticeship he graduated from Glasgow University as Bachelor of Science in Engineering.

Returning to Scotland after a summer spent on railway work in Canada, he spent another winter in the Jas. Watt Laboratories at Glasgow University, and next year he returned to Montreal to take charge of the construction of the Birks Building, one of the first ten-storey reinforced concrete buildings in Montreal. Next year he joined the firm of Ross and Macdonald, architects, and after spending two years as business manager of their head office, in Montreal, he came to Toronto as their Ontario representative. He served in this capacity for five years, during which period he handled, among others, such well-known buildings as the Central Technical School, the Royal Bank building, and the Toronto Union Station.

While acting as resident architect on the station work he was asked by the Director of Aviation to take over the supervision of the construction of the Canadian Aeroplane plant, and shortly afterwards he was appointed chief engineer of the Aviation Department of the Imperial Munitions Board.

In this capacity Mr. Carswell spent two years on the design and construction of all the Royal Air Force Barracks, repair parks and flying fields throughout Ontario. He organized a construction force with departments covering plumbing, heating, electrical work, telephone work, road building, and building construction. This work was scattered over a two hundred mile radius and construction camps had to be maintained, entailing a large commissary department to feed and house the men. This construction force, at times, numbered over two thousand men and the expenditure was over four hundred thousand dollars per month.

At the close of this work Mr. Carswell, with two of his former associates, formed the Carswell Construction Company, which is now operating a general contracting business in an extensive way in Toronto and neighborhood.

J. B. Carswell

Mr. Carswell is an Associate Member of the Institution of Civil Engineers and of the Engineering Institute of Canada, and is a well known member of the Engineers' Club in Toronto.

varying conditions in each individual province. There are provincial governments to deal with, provincial labor bodies, and provincial organizations representing manufacturers and supply men. Besides there are many practical problems of the industry, such as availability of materials, transportation facilities, fuel supply and so on, which affect some of the provinces differently from others, and some phases of these problems can best be handled by a provincial body.

Therefore, it will be seen that to achieve a complete, flexible and workable organization, we must have these three links—the district or local exchange, the provincial executive and the Dominion executive. The local exchanges deal with matters which affect the trade in one particular town, city or district, and they elect representatives to the Provincial executive, which handles provincial affairs, and in turn elects representatives to a federal council. It is really unnecessary, under this scheme, to have more than one representative from each province on the Dominion executive, and on this account there is a huge saving in time and money, as compared with an unwieldy Dominion Association with an individual membership extending all over the country, who, when any matter of importance arises, must all be called together to discuss it or else must leave the matter entirely to the decision of an bureaucratic executive. The scheme we have suggested, however, is essentially democratic. If any question comes up which demands attention by the Federal executive, every local unit has the means, through its representative, of expressing its views or making a protest. Voting powers of representatives should be in proportion to the numerical strength of the exchanges they represent, and provincial executive meetings should be called upon request of a given number of "locals" in each province, as may be determined at the Conference. Similarly a Federal executive meeting should be compulsory upon petition of a determined number of Provincial representatives.

There is a very definite need for a Dominion organization, but we do not believe it can be held together for long through any other scheme than the one suggested. The individual member will soon lose interest in a Dominion Association, with headquarters a thousand miles away, unless he is kept in touch with it through the local organization. We hope our readers will give the proposal their careful consideration.

The second annual aeronautical exposition under the auspices of the Manufacturers Aircraft Association, Inc., will be held in New York on March 6-13 inclusive.

Rapid Sand Filtration Plant at Hawkesbury

Detailed Description of Plant for Purification of the Water Supply of Ontario Town on the Ottawa River

By J. O. Meadows*

After investigating the water supply of Hawkesbury, Ont., the Provincial Board of Health of Ontario ordered the municipality to construct a filtration plant for the purification of the public water supply. Hawkesbury is located on the Ottawa River about 50 miles west of Montreal; its population is about 5,500 and its chief industry is the manufacture of pulp and lumber.

The Ottawa River at Hawkesbury is not a highly polluted stream but it receives the sewage of the municipalities located above and a certain amount of pollution is present in the Hawkesbury supply at all times. This pollution reaches its maximum when the river is at its low stages because, at such times, the sewage entering the stream receives less dilution.

The new purification plant adjoins the old pumping station, the west wall of the pumping station being also the east wall of the filtration plant. A passageway connects the two stations and makes it possible for the same staff to operate both the purification plant and the pumping station.

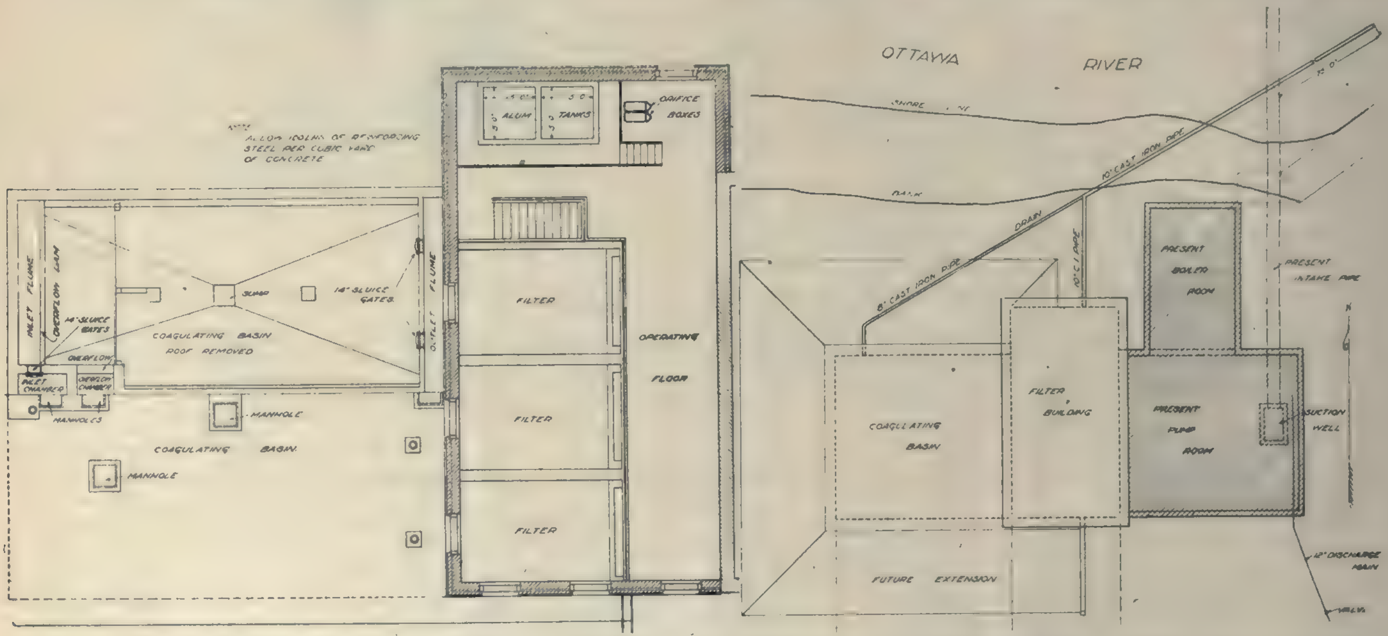

Fig. 1—Rapid sand gravity filtration plant at Hawkesbury, Ont.—location plan on the right and plan of operating floor on the left.

The filter plant consists of several distinct and related parts, viz., low lift pumps, coagulation basin, chemical solution tanks and chemical feeding devices, filters, pipe gallery, operating floor, chemical storage, and clear water basin. The coagulation basin, clear water basin, filters and chemical storage tanks are constructed of reinforced concrete. The concrete used where watertightness was required was composed of one part cement, two of sand and four of crushed stone. No waterproofing material was used to secure a tight job. The super-structure over the filters, operating floor, and chemical tanks is of brick, the 15 in. wall being laid with a 2 in. air space. The roof is supported on 15 in. I-beams and covered with Barrett specification 20-year guaranteed roofing. The ceiling is sheathed with 3 in. T. & G. sheathing.

Low Lift Pumps

The low lift pumps consist of two direct connected Allis Chalmers centrifugal pumps, each having a capacity of 750 gals. per minute against a head of 30 ft. One pump is driven by an electric motor and the second by a steam turbine. The motor driven pump will serve as the regular pumping unit, the steam turbine driven pump only being used when the regular unit is out of service. The low lift pumps take their water from the intake well through a 10 in. suction and discharge into the inlet chamber of the coagulation basin through an 8 in. cast iron discharge line. The discharge of the low lift pumps is regulated by a double disk valve actuated by a 30 in. float. This regulating valve is located on the discharge line. A stem connected with the valve disks passes through two stuffing boxes and connects with the float, the float chamber of which is connected with the coagulation basin by a 1½ in. line, thus maintaining the same water level in the float chamber as obtains in the coagulation basin.

Chemical Solution Tanks

The two chemical solution storage tanks, each with a capacity of 620 gals. are constructed of reinforced concrete and located on the operating floor level. The inside of these tanks is protected with Everlastic cement paint and each tank is provided with a dissolving tray, shut off valve, motor driven agitator, depth gauge and alum solution filter. The piping and fittings in connection with the alum solution tanks are of acid proof bronze or lead. Drain outlets are also provided from each tank.

The alum solution from the storage tanks is

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*Sanitary engineer, Montreal Water and Power Company.

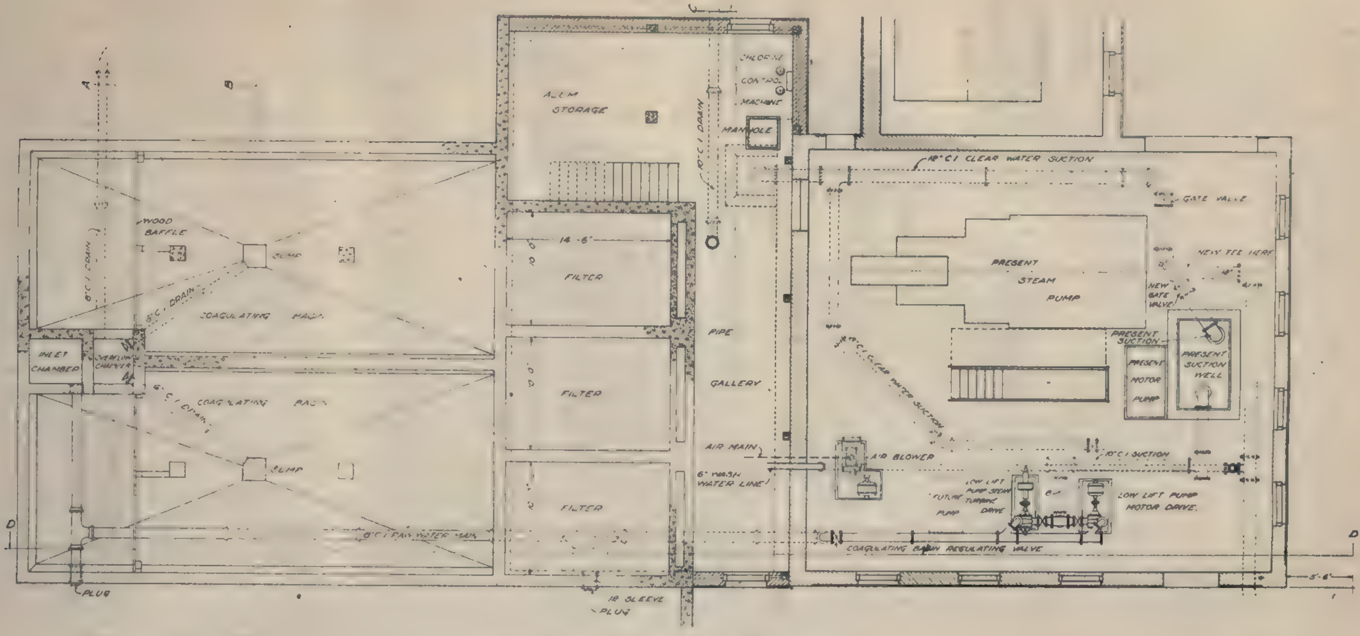


Fig. 2—Sectional plan of filtration plant

measured through lead-lined orifice boxes and is applied to the raw water in the discharge line from the low lift pumps. A secondary coagulation treatment is also provided to the already treated water directly in front of the outlet of each section of the coagulation basin.

Coagulation Basin

The coagulation basin is in two sections, each section being 40 ft. long by 18 ft. wide by 16½ ft. deep. A storage or retention period of 3½ hours is provided by the basin when the filter plant is operated at its rated capacity of 1,000,000 gals. per day. The alum-treated water enters the basin from the inlet chamber, passes down toward the bottom of the basin and under the baffle placed near the inlet end of the basin and then flows to the outlet flumeway. Each section of the basin is provided with two 14 in. diam. sluice gates into the outlet flume and one 6 in. drain. The end of each drain line is located in a sump and the control valves are located in the dry or overflow chamber adjoining the inlet chamber. An 8 in. drain line leads from the dry chamber to the bank of the river where it connects with the 10 in. sewer line from the filters.

The three filter units each have a filtering capacity of 240 gals. per minute. The strainer system of each filter consists of the 6 in. manifold, the lateral pipes and strainer valves. The manifold pipe is provided with 2 in. connections on each side spaced 10¼ in. apart, into which are placed the cast iron lateral pipes. The lateral pipes are drilled and tapped on one line every 6 in., to receive the composition metal strainer valves. After installation the manifold system was imbedded in concrete to the top of the lateral pipes.

On top of the manifold system is placed 9 in. of graded gravel, varying in size from 1 in. to ⅛ in. Directly above the gravel is located the air manifold system which consists of the 2½ in. air pipe drilled and tapped every 4 in. on both sides to receive the ⅜ in. brass air tubes. These air tubes are slotted on alternate sides every 2½ in. and are connected at both ends with the air pipe. The 27 in. of filtering medium is placed on top of the gravel and air manifold system. The filtering medium consists of two parts filter sand and one part crushed marble, the marble being of the same size as the sand.

Each filter is provided with two 10 in. special design cast iron wash water gutters equipped with concrete sand catchers and air vents. At the inlet end of the filter the gutters are attached to the two 10 in. hydraulic influent gates and at the outlet end, to special wall castings in the breast wall of the

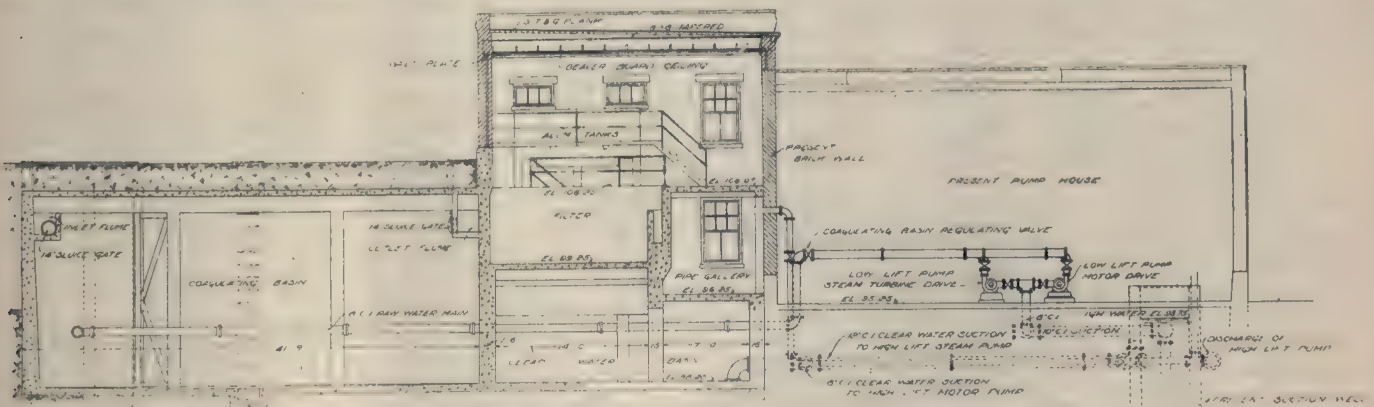


Fig. 3—Sectional elevation on line D-D (Fig. 2)

sewer sump. The lips of the gutters are planed to a true line and are placed level with respect to each other in the same filter unit.

Each filter unit is equipped with the necessary filter piping, loss of head gauge, and rate controller.

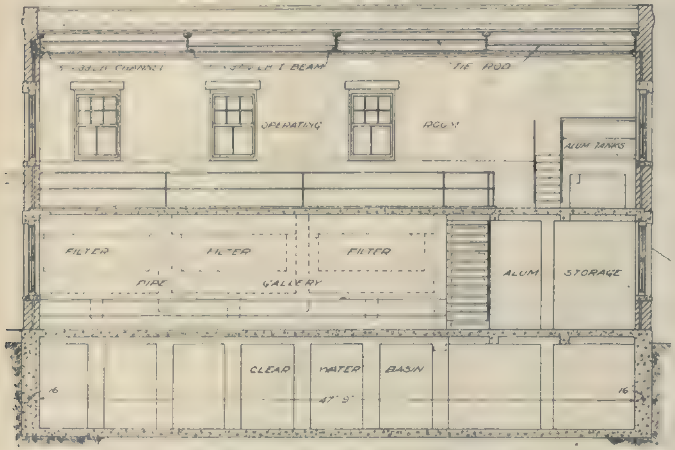


Fig. 4—Section on line C-C (Fig. 2)

The rate controller is of the Venturi type and each controller is so arranged that it can operate separately or in series with the other controllers, control in the latter case being provided by the master controller.

The filter bed is washed with air and water simultaneously, as the air and wash water are supplied through seperate manifold systems. In washing the filter the air is shut off about one minute before the wash is completed to allow the wash water to level the filtering medium.

Pipe Gallery and Clear Water Basin

The pipe gallery is located on the ground floor and in front of the front wall of the filters. In it is located all the necessary piping, valves, loss of head tubes, and rate controllers. Adjoining the pipe gallery is the chemical storage room where sufficient space is available for the storage of a car load of filter alum.

The clear water basin is located below the filters and pipe gallery and has a capacity of about 50,000 gals. On the side of the clear water basin adjacent to the pumping station is located a sump in which is placed the end of the suction line to the high lift pumps. Also at this point the chlorine is supplied to the filtered water to effect sterilization. A clear water depth gauge with high and low water alarm is also provided.

Auxiliary Mechanical Equipment

The motor driven air blower is located in the pumping station and is controlled from the filter operating floor.

Water for washing the filters is taken from the 12 in. line to the 100,000 gal. service tank, through a 6 in. cast iron pipe connecting with the wash water line to each filter.

A Wallace and Tiernan manual control pulsometer type chlorine control apparatus is provided to chlorinate the filtered water as it passes from the clear water basin to the high lift pumps.

Filter Test

Work on the filter plant was started in September 1918 and completed in June 1919. On August 4th and 5th an efficiency test was run on the plant and the following table is a summary of the bacteriological results obtained at that time.

Summary Table

Source	No. of Samples	Bacteria per C.C. 20 deg. C.
Raw	4	1670
Settled	4	95
Filtered	12	30

An agreement between the town of Hawkesbury and the engineer provides for operating supervision of the filter plant for one year after the completion of the work. The filter operators have been trained to take the necessary records and data cards have been provided for their use. Two or more series of water samples are taken each month for analyses and a close check is kept on the operation of the plant.

Cost and Personnel

The cost of the filter plant including the low lift pumping equipment was $49,100. The contract was awarded to Archambault & LeClair of Montreal, with the Norwood Engineering Co. of Cowansville, Que., as sub-contractors for the filter equipment. Jas. O. Meadows, sanitary engineer of Montreal acted as engineer for the town, with Victor Belanger as resident engineer.

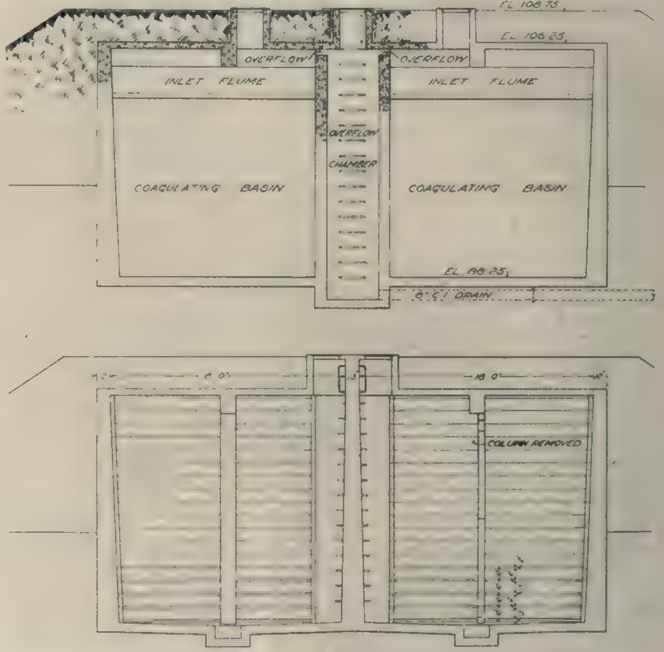


Fig. 5—Upper: Section on line A-A. Lower: Section on line B-B.

Report of Hydrometric Surveys

The Department of the Interior, Ottawa, has issued a report of the hydrometric surveys in the provinces of Alberta and Saskatchewan for the year ended September 30, 1917. The report has been prepared under the direction of F. H. Peters, commissioner of irrigation, by P. M. Saunders, chief hydrometric engineer, assisted by G. R. Elliott and V. A. Newhall, divisional hydrometric engineers. The hydrometric survey operations in Alberta and Saskatchewan are carried on by the Reclamation Service of the Department of the Interior.

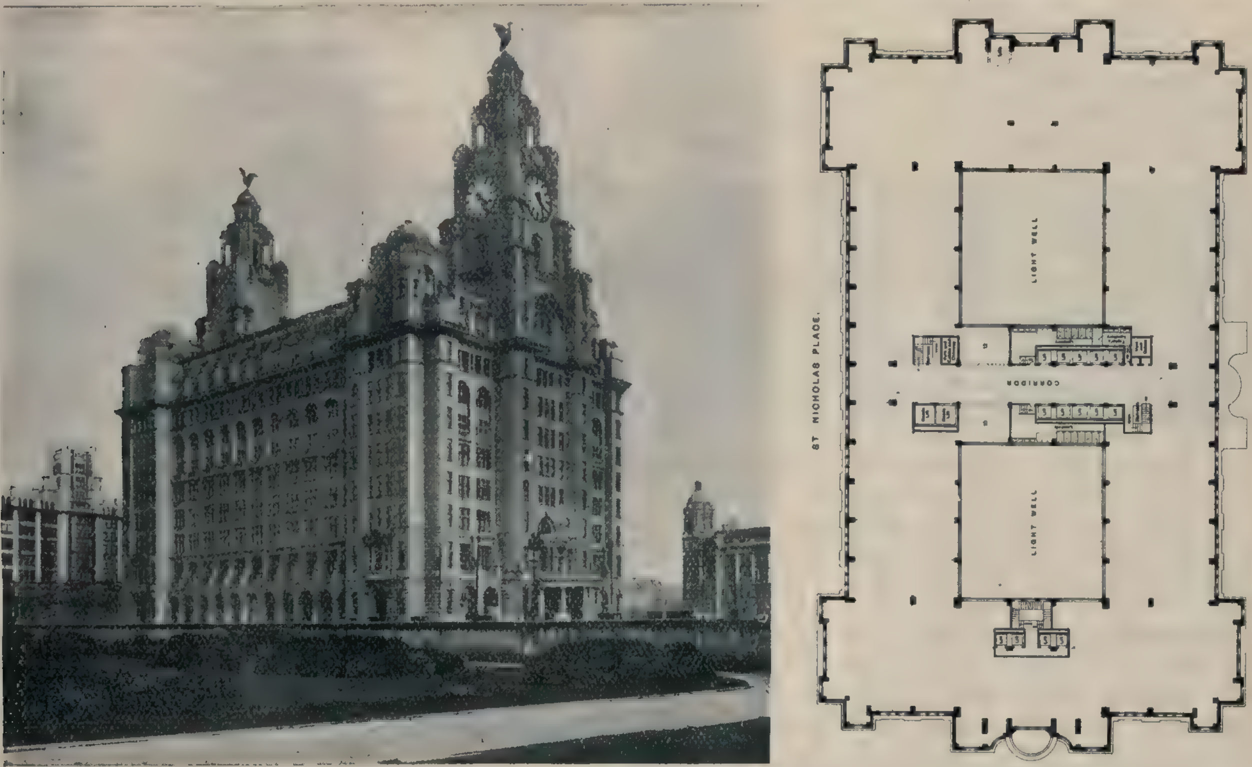
The U. S. Federal Board for Vocational Education has distributed volume two of its third annual report entitled "Vocational Rehabilitation."

Elevating the Status of Reinforced Concrete

Construction of Concrete Buildings on Wrong Basis—Employment of Specialists the Remedy — Tests Prove Fallacy of Building Ordinances which, as they Exist, are Prejudicial to Concrete

By F. G. Engholm*

THERE is something wrong with regard to the way in which reinforced concrete buildings are controlled, and I will endeavor to explain the reason. Reinforced concrete is a building material which is manufactured on the site, and the manufacturer is the contractor. Considering the component parts of reinforced concrete—cement, sand, stone, steel and formwork—the only one which is a finished manufactured product is the cement. The sand and stone are raw materials having a very low bulk cost compared to any manufactured product. The lumber used in the formwork is rough material and the steel is in the form of ordinary round rods which bear a very low cost of manufacture, so low, in fact, that they might be classed, comparatively speaking, as raw material. The commercial power of vested interests in the manufacture of cement, sand, stone and reinforcing steel is small compared to the commercial power of the manufacturing interests of other building materials, such as structural steel, terra cotta tile, brick, timber, etc. Apart from the cement manufacturers, no one possesses any real power or is able to provide the necessary funds to advertise and push reinforced concrete as other materials have been pushed. Business people who have the power of placing contracts have very little information on the subject.



An excellent example of what may be accomplished with reinforced concrete—the Royal Liver building, Liverpool, Eng. Spans range up to 60 feet

Secondly, it is comparatively easy for an architect or an engineer to design in steel, timber, etc., and superintend the construction. The calculation and construction is simple, and he is able to do the work himself. In the case of structural steel, the shop drawings are invariably prepared and paid for by the fabricating works, and the engineer or architect is relieved of that responsibility. If the architect or engineer employs reinforced concrete he does so only at considerably increased trouble to himself and corresponding increase in the expenses. It pays him to employ reinforced concrete specialists, but in so doing he has to obtain permission from his employers or clients, and this reflects sometimes upon his own ability in the eyes of the client or employer. This, of course, is due to entire lack of understanding.

A reinforced concrete engineer who has made a life study of the work and employs an expert staff to do the work, can save tremendously compared with the efforts of anyone who is not familiar to any high degree with the subject. The actual cost of special engineering service in connection with reinforced concrete construction is absolutely negligible compared to the saving it is possible to effect over other materials of construction and the employment of engineers to design reinforced concrete structures who lack practical experience.

Thirdly, as I explained before, reinforced concrete

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*Of F. G. Engholm & Partners, civil engineers, Toronto, before Toronto Branch, E.I.C.

The La Salle bridge, Montreal, is another splendid example of reinforced concrete work. This construction view shows the plant for placing concrete.

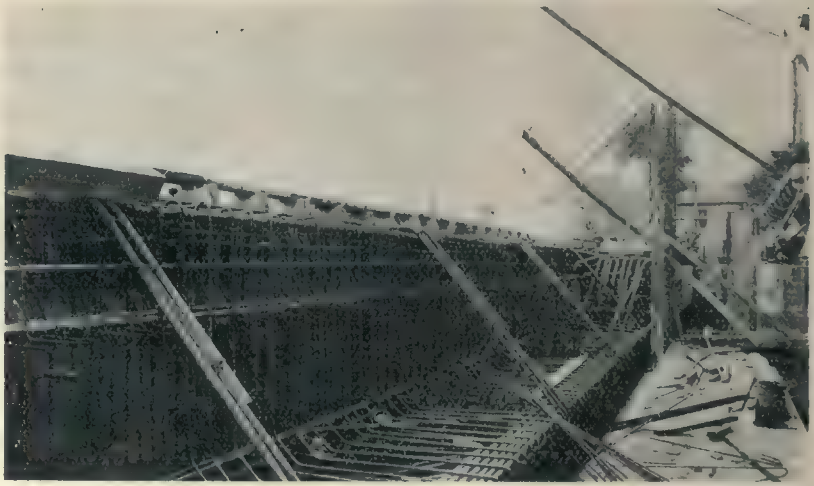
is manufactured on the site. Now, in the process of manufacturing a material, the work of manufacture is thoroughly inspected and material is tested at the various stages of production with minute care, so that any error is corrected in the process of manufacture. Reinforced concrete is no exception, and it is absolutely essential to check up the manufacture of the material in all its stages by expert supervision. Again, the cost of this expert supervision is absolutely negligible compared to the results obtained, but all this comes under the heading of expert or special service, and any money expended theron sticks out over and above the contract price and is looked upon by the owner from an entirely wrong point of view. He does not appreciate that he is getting full value for such an expenditure, and looks to his engineer or architect to supply such special service for nothing. I believe, when this difficulty is fully appreciated and understood by business men, there will be considerable increase in the use of reinforced concrete as a material of construction.

Unscrupulous Competition in Designing

The difficulty of providing this special engineering service has led to great abuse of reinforced concrete as a material of construction. In the age of the deformed bar the market was flooded with special sections of steel bars which, like a quack medicine, were supposed to do all kinds of things. In the early days there was, of course, a big difference between the cost of reinforced concrete structures and other forms of construction, and contractors tendered on a reinforced concrete scheme as an alternative method of construction on any job they were able to, and large profits were made. Engineers, seeing this difference in price, sought a means of attaching their name to some special bar with a few notches in it, or bumps on it, to establish an engineering practice in which designs and engineering service were supplied "free of charge" if this particular form of steel reinforcement was specified. Much unscrupulous competition was indulged in by these engineers competing among themselves for work and many unsafe structures were built, and trouble occurred. Hence the rigid by-laws and the prejudice against Reinforced Concrete construction on the ground that it is not safe. I am glad to say that this condition is coming to an end and the situation is being more fully understood.

Notwithstanding these and other obstacles reinforced concrete has made great headway, and has proven itself, when properly designed and constructed,

The design of reinforcing requires fine detailing. This illustration of the curtain wall reinforcement of the La Salle bridge, Montreal, indicates the necessity of employing specialist service for concrete design.

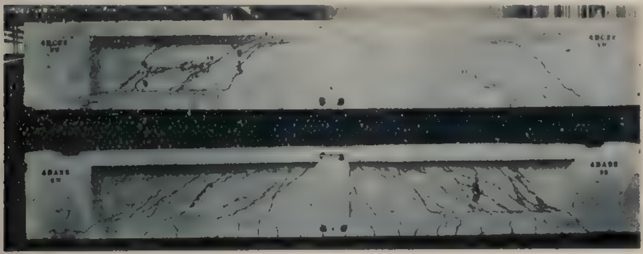


to possess the highest ideals in efficiency and permanence of any form of construction known to engineering science at the present day.

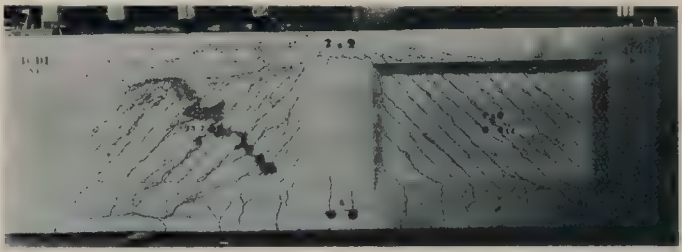
Tests Show Up Fallacies

The United States Bureau of Standards, together with the Emergency Fleet Corporation, have been conducting the most comprehensive tests on reinforced concrete that exist at the present day. They have shown up many fallacies, and have definitely proved that various by-laws have fallen very wide of the mark in the control of stresses, etc.

The fact was that if ships were to be made of reinforced concrete and were to comply with any of the existing by-laws and regulations for reinforced concrete it would be necessary for them to have shells at least 15 in. thick as compared with 4 in. finally adopted. Tests of large reinforced concrete beams were started to make certain that no mistake was being made in using the 4 in. shell. These first tests were made on:— (a) Beams 4 feet 4 inches deep and 18 feet 6 inches long; (b) one beam 10 feet deep and 22 feet long; and (c) specimen ship frames of full-size cross-section and 20 feet span. The frames were cut off at a point corresponding to the point of inflection or 4 feet 6 inches above the top of the keel.



Test of beams in which span is greater in proportion to depth than other beams tested. Note diagonal cracks still maintain an angle of 45 degs.



Shows typical failure of the concrete by diagonal compression in beam where shear steel is provided in excess. Note number and equal distribution of cracks

The tests were made in the 10,000,000-pound testing machine at the Bureau of Standards, Pittsburgh.

For the beams the load was applied at the centre of the span upon the upper flange. The beams were supported at each end on a steel plate girder. The beam 10 feet deep was first loaded forty times with 640,000 pounds, which was four times as much as the maximum which the Standards of the Joint Committee on Concrete and Reinforced Concrete would have allowed as its working load. The widest crack at the first application of this load was thirteen one-thousandths of an inch, and with forty repetitions of the load there was no appreciable increase in widths of cracks. The beam was then inverted and load was applied in the opposite direction, causing failure at 1,363,000 pounds or nine times as much as the Joint Committee standards for reinforced concrete design would have allowed as a working load.

To about the middle of 1919 over 600 beams and ship frames were tested. These beams varied in depth from 18 in. to 10 feet and in lengths varying up to 20 feet. The tests involved over 20 items of interest including bond, shear, etc.

Investigation of Shear

Owing to the limited space it will be impossible to give anything approaching a comprehensive description of the tests. I shall take up just one particular point, namely, investigation of the shear.

A certain number of beams were made with webs reinforced against shear in various ways. In some, vertical stirrups alone were employed. In some, diagonal stirrups sloping upwards towards the supports were employed. In some, diagonals in both directions sloping both upward and downward towards the supports crossing each other at an angle of about 90 degrees, were employed. In others, horizontal bars were also used.

The main tension and compression members of this series of beams were made strong in proportion to the webs in order to ensure a failure by shear. The web thickness varied from 3 in. to 8 in., the main members projecting about 6 in. on either side of the web.

In order to overcome the discrepancies which might result from the fact that the main members composed a rigid frame around the web, one series of beams without the webs was tested, and from the results obtained it was possible to deduce very closely the true shear value of the web.

The failures were practically all shear failures as designed, and the diagonal cracks, no matter what the relation of depth to length, were inclined as shown in the illustrations, at an angle of about 45 degrees. The cracks were actually very minute in width so that it has been necessary to paint them that they may show up properly in the photographs. With the high percentage of web reinforcement the diagonal cracks were finer and uniformly distributed over quite a wide area, while, with smaller percentages of web reinforcement, the cracks were fewer and further apart, and at the same time wider.

It was found that the shear carried was dependent upon two things: firstly, the amount of shear reinforcement, and secondly, the diagonal compression strength of the concrete, values as high as 2,500 lbs. per square inch being recorded at failure, with a concrete having an ultimate strength in straight compression of about 4,000 lbs. per square inch.

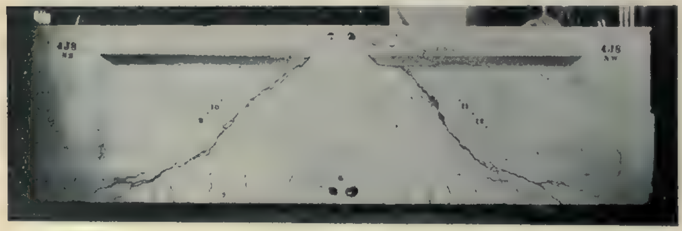
It can easily be seen that if all the shear is taken by the steel the only limitations to the ultimate strength of the member are the amount of shear reinforcement and the diagonal compressive strength of the concrete in the web.

The arbitrary restrictions of the various by-laws, Ontario Railway & Municipal Board specifications, etc., limiting the shear stress under these conditions to such values as 100 or 120 lbs. per square inch are utter fallacy.

Text Book Theories at Fault

The tests carried out by the Emergency Fleet Corporation have distinctly shown that text book theories are largely at fault. Many people have the opinion that because they see something in print in a text book they think it must be absolutely authentic and unquestionable. This point of view is entirely wrong. I know of one case in particular. Two men wrote a text book on reinforced concrete about as big as a family Bible, but I do not think that either of them had actually carried out or been responsible for carrying out, designing or supervising any reinforced concrete work at all. They were clever mathematicians and very good hands with the scissors and paste. One, generally speaking, finds on investigation that the writers of text books on reinforced concrete construction have usually been responsible for only very few jobs. Other writers, of course, we at once realize have had most creditable experience, and we highly value their works. Of course, a large number of men who happen to be in possession of a $5 text book on reinforced concrete consider themselves highly qualified reinforced concrete engineers by virtue of this text book and one often comes across a considerable amount of work carried out by such people. Hence more prejudice against reinforced concrete.

The results of the Emergency Fleet Corporation and United States Bureau of Standards' tests are not new. It has been Hennebique practice since the beginning practically to design reinforced concrete structures in which the steel takes the entire shear stresses in beams, floor slabs, etc. The shear of the concrete works out to values up to 300 lbs. per square inch. The all-important thing in the reliability of any reinforced concrete structures, especially against any unforseen forces, is that the steel should take all the shear. Take the Edison factory, for instance. In such a factory, bearing such a name, one would naturally expect to find very high-class engineering shown in design of all work in connection therewith. This building was designed in 1907, but the reinforcement was of the crudest nature. The column reinforcement consisted of four single rods with absolutely no horizontal ties whatsoever throughout the whole length of the column. There were other equally crude methods displayed in other parts of the structure.



Shows diagonal tension failure where steel provided is insufficient. Note the small number of cracks

There is no secret in any way now existing about reinforced concrete. The experimental work of the United States Bureau of Standards and the Emergency Fleet Corporation is public property and open for the benefit of the world at large. Experiments have been conducted by independent parties and are absolutely unquestionable in their authenticity, and can be accepted without any qualms whatsoever. It is possible that millions of dollars can be saved in building and engineering construction throughout Canada by the proper revision of by-laws throughout the various cities with regard to reinforced concrete construction. An excellent opportunity exists at the present time for the formation of a special committee of reinforced concrete engineers to study the experimental data of the Emergency Fleet Corporation and United States Bureau of Standards and to make proper recommendations to the various cities for changes in the various by-laws. Business men should be made acquainted with these changes and become familiar with the saving such changes would involve in construction so that they can definitely demand that the building codes be revised. In these days, when the cost of construction has almost risen out of sight, and where millions of dollars' worth of work is being held up because of this high cost and the manufacturing business in Canada is suffering severely from the situation, there is an urgent call for immediate action.

I am giving herewith a table showing the stresses determined by the various authorities as shown. In the last column I am showing what I consider good values which would serve the public in the best manner possible to give combination of high efficiency and safety.

Low Stresses are no Protection

It must be realized that in reinforced concrete low stresses do not serve a particularly useful purpose to protect the public against poor workmanship. Designers are forced to design along certain lines in order to achieve the most economical results and yet pass the by-laws. The general tendency of these by-laws is to call for work with a large amount of concrete and small amount of steel, having exceptionally heavy deadweight of structure. This does not necessarily protect the public because, for instance, if concrete is entirely relied upon to take compression and shear stress, and if by any manner of means any reversal of stress takes place, it would tend to introduce tension into a member instead of compression, and the structure would collapse if no steel were used at this particular point. If the designer used less concrete and put some steel in at this particular point the structure would resist successfully considerable reversal of stress, and no trouble would arise. The designer would undoubtedly prefer to do this, but he would get little or no credit for such method of construction. So that under the existing conditions the public are not necessarily safeguarded by low stresses.

I am of the opinion that the arbitrary values for the bending moment in continuous and semi-continuous beams should be entirely abolished and the bending moments used should be those which are the maximum that actually can occur in the structure. The arbitrary values given by the City of Toronto, the Joint Committee, U. S. A., and the Ontario Railway & Municipal Board are as follows:

Arbitrary Bending Moments

	Semi-Continuous		Continuous	
	Centre	Support	Centre	Support
Tor. City By-laws, Original	$+wl^2/9$	$-wl^2/9$	$-wl^2/10$	$+wl^2/10$
" " Concession	$+wl^2/10$	$-wl^2/10$	$-wl^2/12$	$+wl^2/12$
Joint Committee U.S.A....	$+wl^2/10$	$-wl^2/10$	$-wl^2/12$	$+wl^2/12$
Ont. Ry. & Mun. Board..	$+wl^2/10$	$-wl^2/10$	$-wl^2/12$	$+wl^2/12$

The Ontario Railway and Municipal Board gives $wl^2/8$ in column 2 if there are only two spans.

Special attention should be given to the revision of the arbitrary restrictions defining:

1. Load distribution in reinforced concrete;
2. Distribution of stress such as the amount of slab acting as compression member in T beams;
3. Impact.
4. Provision of proper reinforcement to take shear.
5. Anchorage of reinforcement, particularly shear reinforcement.

The above should all be properly revised for

Tables of Permitted and Suggested Stresses

		Toronto By-Laws Original	Toronto By-Laws Concessions	Joint Committee	London (Eng.) County Council, 1915	American Concrete Institute	Emergency Fleet Corporation	Ont. Ry. & Munic. Board	Recommendation for city by-laws
		1		2	3	4	5	6	7
1:2:4 Concrete	Compression in Beams	600	650	650	600	750		600	750
	Direct Compression	450		450	600	500		500	600
	Shear in Concrete	40		40	60	40		40	50
	Diagonal Compression	100	150	100	180	150		120	250
	Hooped cols. lim. concrete stress		650	698	800				
1:1½:3 Concrete	Compression in Beams	750	812	812	675	938		650	1000
	Direct Compression	562		562	675	625		550	700
	Shear in Concrete	50		50	67	50		45	60
	Diagonal Compression	125	187	125	202	188		120	375
	Hooped cols. lim. concrete stress		812	870	900				
1:1:2 Concrete	Compression in Beams	750	975	975	750	1125	1500	650	1250
	Direct Compression	562		675	750	750	1000	550	800
	Shear in Concrete	50		60	75	60	50	45	70
	Diagonal Compression	125	187	150	225	225	500	120	500
	Hooped cols. lim. concrete stress		1000	1045	1000				

With granite or trap-rock concrete, 10% higher stress values are allowed for columns 2, 4 and 7. The stress in steel allowed 16,000 lbs. per square inch for columns 1, 2, 3, 4, 5 and 7, but for some peculiar reason the Ontario Railway & Municipal Board, column 6, will only allow 15,000 lbs. per square inch for the steel. This steel is exactly the same steel for which they allow 16,000 lbs. when used in steel structure. I cannot explain why there should be such discrimination against reinforced concrete.

reinforced concrete, taking into account the monolithic nature of the material.

The only real solution for the safety of the public is that it should be made compulsory to employ a properly qualified reinforced concrete engineer to be made responsible for the design and supervision of construction on the site. He should be independent of the contractor, and he should not be interested in the merchanting of materials in any way. He should be permitted to design the work without any outside competition. It is essential that he should have had considerable experience in the design and supervision of reinforced concrete construction and that he should be thoroughly familiar with the experimental work and teachings of the Emergency Fleet Corporation and the United States Bureau of Standards' tests.

For the information about the tests referred to above, the author is indebted to Messrs. Lord and Slater, of Chicago, who permitted the release of the data. More complete details of the tests are to be incorporated in a paper by Messrs. Lord and Slater.

Town Manager for Kipawa

Under a Bill introduced into the Quebec Legislature, the model town of Kipawa will be incorporated. There is to be a town manager and such other officials as the manager may deem necessary. The manager is to be appointed by the majority owners of the property. Provision is made for the appointment of a board whose duty it shall be to regulate and control and locate all buildings, to lay out the town, to inspect plumbing, electrical instalments, etc., to control and regulate localities where hospitals and schools may be built; to set aside areas where fruit or vegetable growing may be permitted and to regulate the same, and to prohibit such fruit and vegetable gardens elsewhere, and to do all other things for building up a model city. Another bill in the same connection, provides for the incorporation of the Kipawa Housing Company with a capital stock of $200,000.

The Town Council of Grand Mere, P. Q., have accepted an offer made by the Laurentide Company, Limited, to spend for the welfare of the town, the sum of $50,000 per annum for twelve years, of which $40,000 will be spent on permanent improvements and $10,000 for administration. Of the total sum, $200,000 will be spent on a new water works system, which will be commenced in the spring. It is expected that the work will take about eighteen months, and when completed will remain the property of the town. One of the conditions of the agreement between the Company and the town Council is that a town manager is to be appointed by the Company and the town council, his salary being paid by the Company. Messrs. R. S. and W. S. Lea, Montreal, are the consulting engineers.

Annual Meeting of E.I.C.

Combined Business and Professional Meeting on Jan. 27, 28 and 29—Papers Cover Wide Range of Topics

THE annual business and professional meeting of the Engineering Institute of Canada will be held at the Institute quarters, Mansfield street, on January 27, 28 and 29.

It is expected that the convention will be the largest and most representative that has ever been held and it is hoped that it may assist in giving the public a more comprehensive view of the essential work achieved by the members of the engineering profession in building up the prosperity of Canada.

It has been felt that heretofore the work of the members of the engineering profession has not appeared before the public in its true perspective, and an endeavor is therefore to be made to acquaint the public with the scope and importance of the work done by the engineers in developing the natural resources of the country.

On Tuesday, Jan. 27, the opening day, the retiring president, Colonel Leonard of St. Catharines, will deliver his valedictory address. He will be followed by the incoming president, Mr. R. A. Ross, who will make a formal opening presidential address to the members.

Wednesday, Jan. 28, will be devoted to the reading of various papers, dealing with the engineering problems connected with the greater development of Canada. On Thursday, Jan. 29, a discussion of the various papers read will occur and other papers will also be read. This will conclude the professional programme of the convention.

The social programme will consist of many functions to take place at the Windsor Hotel, where the members of the Montreal branch of the association will be the hosts of the visitors. Chief among these will be the annual dinner and "smoker." In addition to these a special list of entertainments have been prepared for the ladies who will accompany the visiting members and will consist of dinners, receptions, teas and dances. A special ladies' committee has been organized to undertake this part of the convention work.

The following list gives the programme of papers for the professional meeting:

"The Training of the Chemical Engineer" by Dr. H. F. Ruttan, M.A., M.D., Sc.D., F.R.S., Professor of Chemistry and Director of the Chemical Laboratories, McGill University.

"The Importance of Physics in Engineering Education" by Dr. A. S. Eve, D.Sc., C.B.E., F.R.S., Macdonal Professor of Physics, McGill University.

"The Forests of Quebec" by G. S. Piche, A.M.E.I.C., Chief of Forests Service, Quebec Lands and Forests Department.

"Quebec's Water Power Policy and the work of the Quebec Streams Commission" by Oliver Lefebvre, B.A.Sc., C.E., A.M.E.I.C., Chief Engineer, Quebec Streams Commission.

"The Operation of the Quebec Public Health Act" by Theo. J. Lafreniere, B.A.Sc., C.E., M.Sc., Chief Sanitary Engineer to the Superior Board of Health of the Province of Quebec.

"Quebec Highways" by Alex. Fraser, B.A.Sc., C.E., A.M.E.I.C., Assistant Chief Engineer, Quebec Department of Roads.

"The Pulp and Paper Industry" by Ferd. van Bruyssel, C.E., D.P.S.

"The Policy of the Canadian Air Board" by Colonel C. M. Biggar.

In addition to these papers it is expected that there will be an address at the luncheon on January 17th, by Mr. E. W. James, Assistant Chief Engineer, Bureau of Public Roads, Washington, entitled "Modern Highways Problem."

Montreal Builders' Exchange

Object to Giving Certified Cheques and Complain About Removal of Contractors' Signs—Finances Satisfactory

IN the ordinary course of events, the January 8th meeting of the Board of Directors of the Montreal Builder's Exchange should have been the last of the year before the annual meeting but on account of the absence abroad of President W. M. Irving, the Directors unanimously agreed to defer this till his return to Montreal. According to the bylaws the annual meeting should this year be held on Jan. 26th but by the generous agreement of the Board this has been deferred to a date when it is expected he will be able to preside. It is anticipated that President Irving will return early in February, and as soon thereafter as possible the annual general meeting will be held. The next meeting of the Board, it was resolved, is to be held on Feb. 9. At the January 8th. meeting, Past President J. P. Anglin, and Vice President J. K. McNutt acted as chairmen.

Committee Reports

Mr. J. P. Anglin for the City Building By-Laws Committee reported that all the recommendations put forward by his Committee on behalf of the Exchange had been adopted by the General Committee and forwarded to the city hall. It was unanimously agreed to continue this committee (J. P. Anglin, K. D. Church, E. B. Evans)so that its members might follow up this matter and cooperate with other bodies in having the proposed building by-laws become operative at as early a date as possible.

Mr. R. F. Dykes in submitting a draft copy of a standard constitution and by-laws for the use of the section and sub-sections of the Exchange recommended that it be submitted to the latter for their suggestions before being adopted by the Board, and this was unanimously agreed to. The chairman of the General Contractors' Section, K. D. Church, reported progress in the drafting of a standard progress estimate sheet for the use of the members.

The secretary submitted a communication from one of the members stating: "It has been the habit of some engineers and architects to require certified cheques, when calling for tenders. We have had several experiences lately which have led us to a decision not to give certified cheques on such private work, and I understand that the general contractors of Toronto have taken similar steps on this point." The Board unanimously agreed that this was a vicious practice, and remitted the letter to the General and Trade Contractors' Sections. One director suggested that members should refuse to give prices to architects who demand certified cheques for private work.

Removal of Contractor's Signs

City by-law 270, section 4, seems capable of various interpretations. It reads, "no person shall place or affix or suffer to remain affixed upon any shop, store or other building, in the city any sign or show-card projecting from the walls or front of such store, shop or building, and extending more than six inches over the sidewalk." One of the members complained by letter that a campaign is being carried on at the present time by the road department, at the city hall, against contractor's signs and noted that several contractors have been obliged to remove their signs. In the case of this member, he had constructed a covered way over the sidewalk with an office on top of the covered way; the sign was on his office as is usual under these circumstances. It was remarked that as the practice has been going on for years and was not confined to building contractors, it seemed strange that its legality or otherwise should be questioned now. It was agreed that Messrs. J. P. Anglin, K. D. Church, and John C. Watson should interview Chairman Decary of the Administrative Commission and have the matter cleared up.

The secretary in submitting his usual monthly financial statement reported that the Exchange had ended 1919 with no liabilities whatever, and a substantial credit balance. This was the first time this had occured since 1897 when the Exchange was instituted. The number of members in arrears at this date was also the smallest on record. He further reported that the various sections and sub-sections were all in a sound financial condition, and were free of any financial obligation to the Exchange. Further details of this and of the large increase in membership that had taken place during 1919 would be submitted to the general meeting which this year will be held about February 16.

Sir John Willison Comments on Ontario's Housing Legislation

Editor, Contract Record;—

Those of us who were associated with the Ontario Housing Committee are more than satisfied with the legislation put through the assembly by the Hearst Government and with the results obtained. Nearly 100 municipalities in Ontario are now committed to housing projects controlled by municipal commissions and approved by the Ontario Housing Department. A great proportion of these houses to be erected will not cost more than $3,500. In many cases indeed they will not cost as much while the annual payment required to obtain ownership over a 20 year period will not exceed the present average annual rental for similar houses. In the other Provinces the public credits have not been used as freely as in Ontario but next season probably building will be general over the Dominion.

It is stated that of all the municipalities building under the Ontario Act, Ottawa's layout is the most attractive while Hamilton has secured the best class of houses for the money expended. But all the Commissions have been active and efficient and the net result will be to improve the character of housing all over the Province and to add greatly to the number of people who will own their own homes in surroundings often as attractive as those with ample means enjoy. Private builders will never again be content to construct long rows of houses of a common type in narrow streets, for henceforth they will be unsaleable, as jerry building in the future will be an offence which no community in Ontario will tolerate. It is satisfactory to know that the many projects entered into by municipalities under the Hearst legislation will be approved by the Drury Government and the necessary credit provided,

J. S. Willison

President, Canadian Reconstruction Association.
Toronto, Jan. 9, 1920.

Municipally Owned Asphalt Plants

We are indebted to the Milton Hersey Co., Ltd. for the information that the following Canadian municipalities now own asphalt paving plants: Charlottetown, P. E. I.; Hamilton Ont.; Kingston, Ont.; Montreal, Que., (3 plants); Ottawa, Ont.; Sherbrooke, Que.; Toronto, Ont.; Victoria, B. C.

Remember the Dates of the A.C.B.C.I. Conference

The following letter has been sent by Mr. J. P. Anglin, president of the Association of Canadian Building and Construction Industries, to the builders, contractors and supply-men of Canada, confirming the announcements made in previous issues of the Contract Record regarding the change in the dates of the conference:

To the builders, contractors and supply-men of Canada:—

In order to avoid conflicting with the annual meeting of the Engineering Institute of Canada, we have decided, after consulting with members of our National Council throughout the Dominion, to alter the dates previously set for our Second General Conference.

We shall now meet on MONDAY, TUESDAY and WEDNESDAY, the SECOND, THIRD and FOURTH of FEBRUARY.

Sessions will be held in the Chateau Laurier, Ottawa, commencing 10 a.m., Monday, Feb. 2nd.

In view of the importance of the problems which face the building and construction industries of Canada this season, we earnestly urge you to attend this Conference.

It will be advisable for you to make your own hotel reservations early, in order to obtain accommodation.

Please advise our Secretary, on receipt of this notice, that you intend to be present.

Remember the dates—Monday, Tuesday, Wednesday, Feb. 2, 3, 4.

Yours very truly,

J. P. Anglin,
President.

Batiscan Bridge Links Montreal and Quebec

Quebec Government Plans Erection of 1211 ft. Structure Over the Batiscan River to Dispense with Hand Ferry

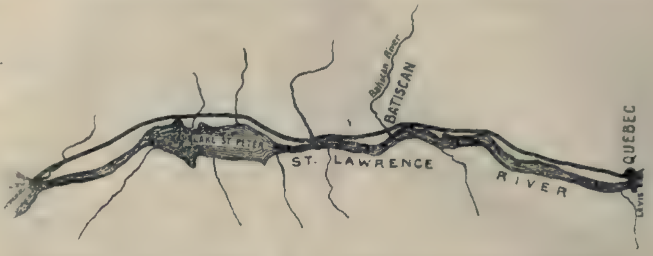
By F. B. Painchaud*

THE spanning of the Batiscan river in the province of Quebec will close the gap which has existed up to now in the provincial automobile road linking Montreal to Quebec city. The construction of the bridge which the Quebec government contemplates erecting at this spot will do away with the old hand-operated ferry which is actually the only means of communication between both shores (except in winter when the river becomes frozen) and which sometimes has to suspend temporarily its trips when a strong breeze prevails or when a high tide floods the low part of the road on the north-east shore. Many an automobilist who remembers on such occasions either having been delayed for several hours or having travelled to the nearest bridge at Ste. Genevieve, some six miles upstream and thus lengthening his itinerary by about twelve miles, will be pleased to see the contract for this work awarded.

Location and Description

The bridge is located in the municipality of St. Francois-Xavier de Batiscan, Province of Quebec, and crosses the Batiscan quite close to its mouth where it flows into the St.Lawrence River and about half a mile downstream from the Canadian Pacific Railway bridge. The superstructure comprises seven spans, viz. six steel through truss spans, 189 ft. c. to c. of bearings and one steel through plate-girder bascule channel span of the Strauss type, 62 feet c. to c. of bearings; the latter is necessary on account of the navigability of the Batiscan for small vessels. The superstructure rests on six plain concrete piers and two abutments, carried on wooden piles and with the edges on the up-stream side protected by steel plates against the impact of ice and logs.

The height of the piers varies from 25 ft. to 37 ft. 4 in., and their top width is six feet, except piers no. 4 and 5, for the bascule span, which are respectively seven and eight feet wide. The total length from face to face of abutments is 1211 feet. A reinforced concrete slab 7½ inches thick at the crown and 6 inches at the curb will extend over the entire length of the six fixed spans; but the bascule span is to be floored with 4 in. planking covered with a wooden wearing surface 1½ inch thick to minimize its weight.



The relation of the Batiscan river crossing to the Montreal-Quebec highway

On account of the high cost of material and labor the bridge was designed as narrow as possible, a clear width of 18 feet between wheel-guards being adopted. No sidewalks are deemed necessary as the local traffic is not great.

Built High to Escape Floods

The surface of the floor will be at elevation 40.2 referred to Steckel's datum or 34.22 feet above mean sea level. This elevation, which may seem rather

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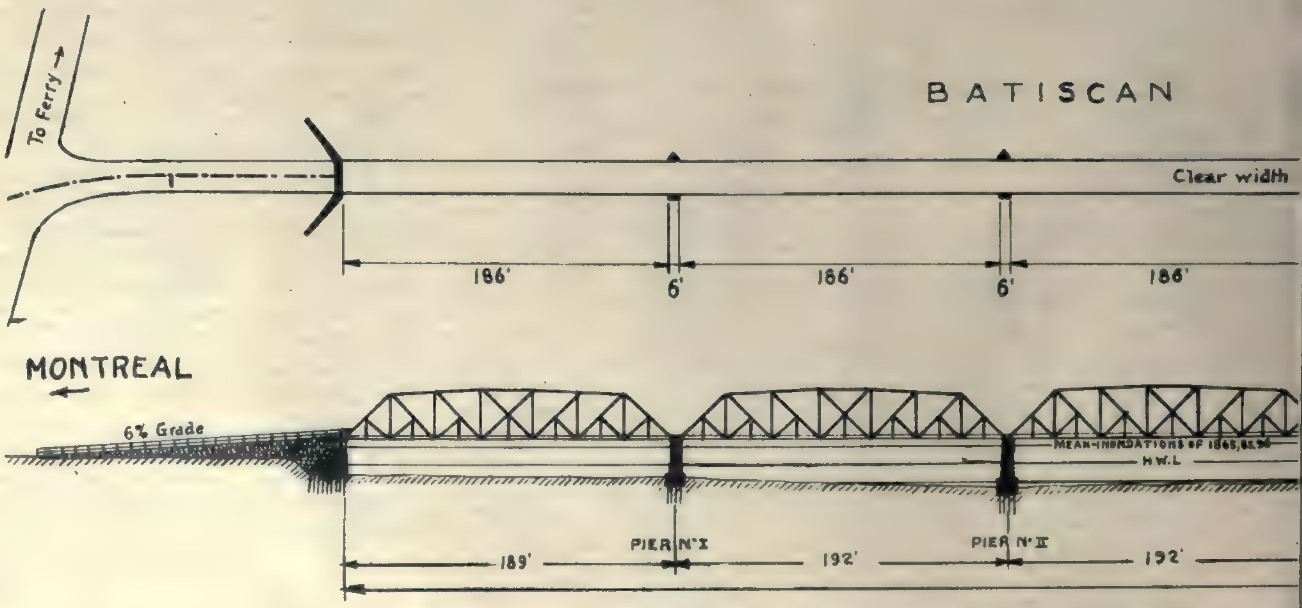
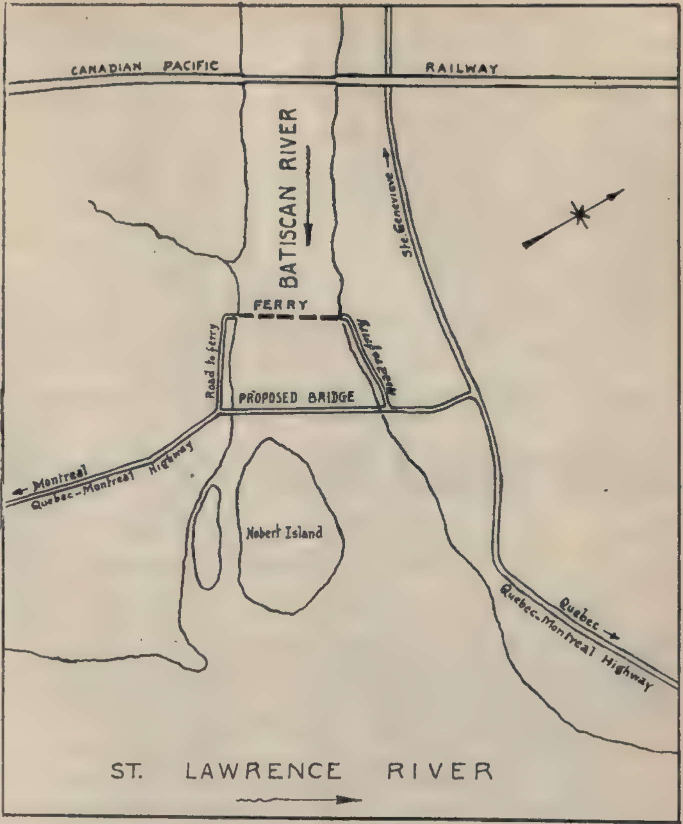
*Assistant to Chief Engineer, Department of Public Works and Labor, Quebec.



A 1211 ft. steel bridge over Batiscan river, P.Q., will close the gap in the provincial great when compared to the ordinary high water and the adjacent country, was based upon the mean level of the floods of 1865, 1885, 1896 which were caused most probably by the ice jam which used to form across the St. Lawrence some distance above Quebec. Respecting this matter it might be of interest to recall that a certain number of years ago the St. Lawrence river used to freeze right across from Quebec to Levis, on the opposite shore, and the writer personally remembers having walked over such a natural ice bridge some twenty-three years ago. Nowadays, the ferry boats which ply between Quebec and Levis all winter greatly prevent the river from freezing across and the ice-breakers which get busy at the end of winter cutting away the ice above Quebec keep the jam previously alluded to from forming and thus prevent the inundations of the past. Should, however, these ice-breakers fail for some reason or other to perform their work, it is believed that such floods as those of 1865, 1885, and 1896 might happen again and for this reason the bridge was made as high as possible to be out of reach of the water.

Specifications and Data

The superstructure is designed in accordance with the requirements of the 1918 specifications of the Provincial Department of Public Works and Labor and of the Engineering Institute of Canada, for a uniform live load of 83 pounds per square foot of floor for the fixed spans and 100 pounds for the bascule span without impact, while the floor members are proportioned to carry a 15 ton motor truck with wheels 6 feet apart and axles 10 feet apart, the rear axle bearing two thirds of the entire load to which an impact of 30% is added. The trusses for the fixed spans will be of the rivetted Pratt type with curved top-chords and subdivided panels or "Petit Truss". The permissible unit tensile stress for the steel will be taken at 16,000 lbs. per square in. of net section.



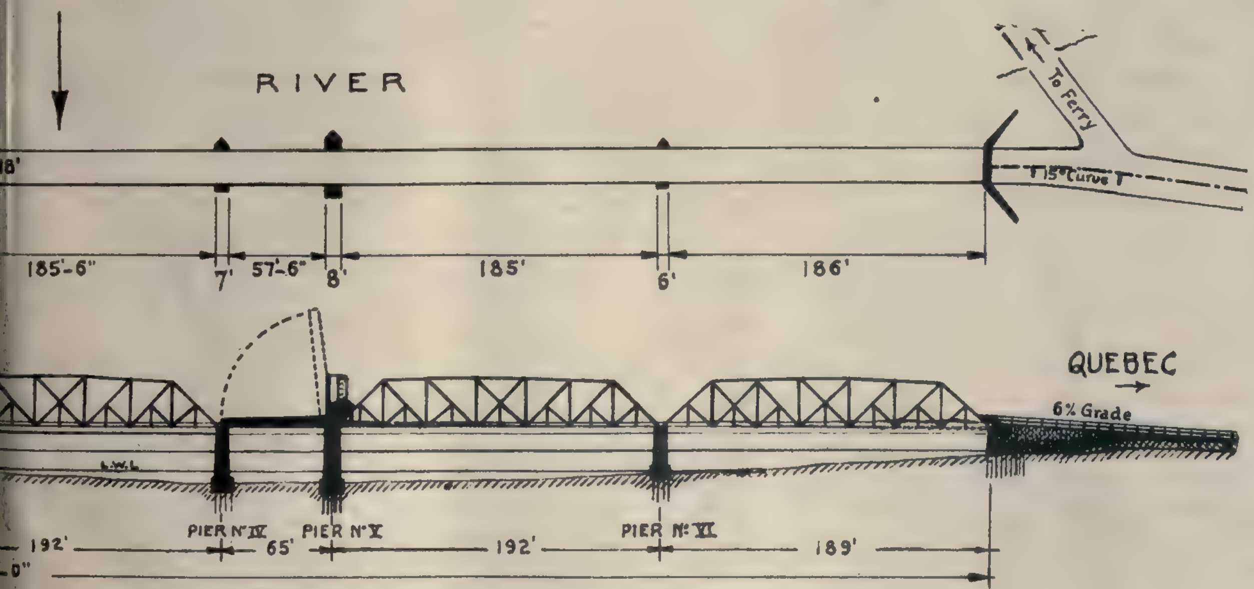
The bridge over Batiscan river will dispense with ferry, heretofore the only means of crossing

The movable span is designed for hand operation for the present as no electric power is now available in Batiscan but the specifications require that the machinery be so arranged as to permit of its conversion to electric operation in the future.

The mixture specified for the concrete is 1:2½:5 for piers and abutments except pier No. 5, bearing the bascule, which requires a 1:2:4 mixture. A 1:1½:3 mixture is used for the reinforced concrete floor slab.

Under the Control of The Provincial Government

As the local traffic of Batiscan does not, in the opinion of the municipal council, warrant the construction



real to Quebec. It will comprise six 189 ft. truss spans and one 62 ft. bascule span of such an expensive bridge and as it furthermore deprives the municipality of the revenue coming from the ferry, the government had to take under its charge the construction of this link in the Quebec-Montreal highway; consequently tenders were called for by the Department of Public Works and Labor which were opened on the 18th of November. The bidders were required to submit a lump sum for the whole work and also separate prices for each of the following items: (a) Superstructure, (b) Substructure, (c) Approaches, (d) Reinforced concrete slab for fixed spans, (e) Royalty for bascule span. The government reserved the right to award if it wished, the superstructure and substructure to seperate bidders. Eleven bids were received, four from steel companies for the superstructure and seven from general contractors, the lowest bidder for the superstructure being the McKinnon Steel Co., of Sherbrooke, at $104,800 and Jos. Gosselin Ltd., of Levis, for the substructure, approaches, and concrete floor at $82,828.60.

The provincial government is now awaiting the approval of the plans by the federal government of Canada before letting the contract because this approval is required according to the law on account of the navigability of the Batiscan river.

Sewage Disposal is Many-Sided Problem

Purification Methods Discussed—Production of Satisfactory Effluent—Disposal of Sludge—Future Developments

By Arthur J. Martin*

BECAUSE the problem of sewage disposal is so complex and many-sided, the task of the sewage works engineer and the sewage works manager is by no means an easy one. When sewage first began to be dealt with the sewage farm manager grew crops with it and was expected to make his farm pay. Chemical precipitation followed and attention was paid to the production of saleable sludge. The foul condition of our rivers attracted considerable notice, and standards of impurity began to be laid down. Mr. Cameron, of Exeter, next came forward with the septic tank, which was followed by the contact bed and the trickling filter systems, when much was heard of the anaerobes and the aerobes, whilst Mr. Scott-Moncrieff insisted on the importance of high nitrification. Just as engineers and managers were settling down to sedimentation or septic tanks and bacterial filters as the standard methods of purification, Professor Fowler and Dr. Ardern and their colleagues bomb-shelled the camp with the activated sludge process. Purification by electrical agency has been introduced by Mr. C. P. Landreth at Easton, Pennsylvania, comparatively recently, but the cost is too high for general adoption; whilst the Miles acid process—with sulphurous anhydride—has been also recently tested at New Haven, Connecticut. It is, however, costly to operate, but it conserves the fixed nitrogen and the grease, so much of which is destroyed by bacterial treatment.

Points Requiring Consideration

The successful purification of sewage depends no less on the selection of the process than on the care with which the details are worked out. Points in current practice which require more consideration are as follows: Why, in continuous flow sedimentation tanks, should the sewage be retained in the tanks for a given number of hours? If septic action be aimed at, one could understand the object, but where it is only to separate the solids from the liquid and to deliver the sewage in a fresh condition, would it not be better to make the tanks as small as possible and rely rather on correctness of form than on a prolonged retention of the sewage? Why, too, are tanks and grit chambers so generally made rectangular? For continuous flow circular tanks, where the sewage enters in the centre, afford the best conditions for the speedy settlement of the sewage. Inadequate pains are taken to secure the settlement of suspended matter between the sedimentation tank and the filter, and sludge valves are frequently found placed at the wrong end of sedimentation tanks—that is, the inlet end.

Attention was drawn some fifteen years ago, chiefly through the work of Dr. Travis, to the presence of collodial matter in certain tank effluents. It would be interesting to know if any of our members had been troubled by colloids, and if so, what means do they employ to get rid of them. Whilst ordinary brick are considered good enough for waterworks filters, it is somewhat singular that an expensive stoneware floor should be required for a filter dealing with sewage.

Believes in Contact Beds

I am one of those who have maintained through good and evil report their faith in contact beds. The sweeping condemnation passed upon them was not, in my opinion, suggested by facts. It was stated that certain results could not be obtained by contact filtration. Yet these results were actually obtained. We were told the contact bed was wrong in principle. Yet the same objection appertains to the activated sludge process. The disfavor into which the contact bed has fallen is largely due, I believe, to the failure to recognize the essential conditions under which it works. In the case of one group of beds which I measured only three-quarters of the effluent which went into them at their first filling was discharged, no less than 25 per cent. of it being retained by the filtering material. The liquid so retained was just 15 per cent. of the cubic contents of the beds, or nearly one-half of their normal working capacity, taken at 33 per cent. of the whole. As time goes on the amount of tank effluent dealt with at each filling diminishes, while that held in the interstices of the filtering medium increases, so that when a bed has been long in use the volume of liquid permanently held up in it may be not far short of that which it receives at each filling. The liquid so held up by the bed, surrounded as it is by air, is under the best conditions for purification, and the work goes on uninterruptedly during the whole period that the bed is supposed to be at rest. Not only so, but the oxygen dissolved in the retained liquid and the nitrates formed in it aid materially in the purification of the next dose of tank effluent.

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*President of the Association of Managers of Sewage Disposal Works, in his inaugural address.

I do not wish to claim for the contact bed more than its due, but I do claim that, given the same consideration as regards bed material, drainage, aeration, and mode of working which is bestowed on a trickling filter, the contact bed is a valuable instrument for the purification of sewage. Where the available fall is too little for a trickling filter or where the spraying of tank effluent is likely to be objected to, a well-designed group of contact beds will often save the situation.

The Activated Sludge Process

The activated sludge process is the most promising novelty for the purification of sewage which we have had for many a long year. The idea of purifying sewage by blowing air through it was not new. It was put forward many years ago by Colonel Waring, in America, and by our own honorary member, Mr. Lowcock, in this country. But nothing came of it at the time. The direct oxidation of sewage is far too long an operation to be effected within the brief period during which the air remains in contact with the liquid. The distinguishing feature of the new process was the introduction of an army of organisms capable of seizing on the air on its way through the sewage and by their life operations bringing about the changes which direct oxidation was powerless to effect.

Most of us can recall the time when the continuous production of a satisfactory effluent was an anxious and difficult task, absorbing all the energies of a sewage works manager. Those days, happily, have long since gone by. Unless he is hampered by inadequate capacity in his works, or by the unregulated discharge of trade wastes of unusual malignity, a manager can turn out with ease and certainty an effluent which will not injure the stream into which it flows. An exception might be made in the case of water in which oysters are re-laid, but even in such cases he has in chlorine an agent which can be relied on to prevent the conveyance of disease germs by the effluent. Had chlorination been available a few years sooner certain seaside towns might have been saved the cost of the exceedingly expensive works which they have had to lay down. But it should always be borne in mind that the best and most effective precautions which can be taken against contamination by the dry-weather sewage will be of little avail if any storm water from the sewers is allowed to escape untreated. The sanitarian is notoriously wasteful. He delights in destruction. But in no direction, probably, does he give his destructive proclivities freer play than in his dealings with sewage. For sewage contains a vast amount of fertilizing matter. As long ago as 1898 we were warned by Sir William Crookes that the question of maintaining the productiveness of our fields might soon become an exceedingly grave one. The past five years have shown us with startling vividness the precarious position of our food supply. We draw heavily year by year upon the fertility of our soil, and year by year we squander plant food to the value of a score of millions of pounds. Before the war we were spending £15,000,000 per annum on manure from South America, but the supplies are fast becoming exhausted, and freights have risen by leaps and bounds. Ambitious schemes for the fixation of atmosphere nitrogen are in the air, and meanwhile a vast amount of fixed nitrogen is being dissipated into the atmosphere or poured away into our rivers and streams.

Sludge Must be Disposed of

But although the anxieties of the sewage works manager with regard to the quality of his effluent have more or less disappeared, it does not follow that he is at the end of his difficulties. We have no sooner vanquished the sewage problem, when our enemy again confronts us in the form of sludge. We may compel it to do our bidding, as in the activated sludge process, but sooner or later we must dispose of it, and unless we do so promptly it will accumulate in portentous quantities, and be an ever-present nightmare on the chest of the unfortunate manager. The difficulty is aggravated by the enormous proportion of water which swells the mass of the sludge, and which ranges from nine times the weight of the dry solid in the case of a well-digested septic sludge to forty or fifty times in that of the activated material. The crux of the sludge problem is generally held to be in the removal of the surplus moisture, so as to reduce the bulk of the sludge and bring it into a manageable condition. This can be done by pressing, but the process is costly, and further expense has generally to be incurred in the disposal of the pressed sludge.

Using Sludge to Press Itself

Some observations which I made many years ago on septic tanks at Exeter and elsewhere seem to point to the possibility of employing the sludge to press itself. It is heavier than water, and when immersed in water each particle exerts on those below a pressure due to this difference in weight. The lower layers are thus compressed, and a part of the contained water displaced. An examination made at Exeter in December, 1900, of a septic tank which had been in continuous use for four years showed a depth of sludge of about 4 ft., the percentage of moisture being, for the upper layer, 89 per cent., at mid-depth 84 per cent., and at the bottom 80 per cent. The comparative dryness of a well-digested and compressed sludge is well shown by its consistency (resembling that of a tough mortar), when forced through the cleansing valves of a tank by the pressure of the sewage; while if it is not drawn off regularly it sometimes becomes so compact that it refuses to move.

Such being the effect of compression in the comparatively shallow layer of sludge on the floor of a tank, it seems reasonable to expect that with a greater depth still more satisfactory results would be obtained. I have little doubt that septic sludge, if run or pumped into a shaft, which may easily be 20 ft., 30 ft., or even 40 ft. deep, would speedily become consolidated, a large proportion of the water which it contained rising to the top of the shaft, and that in a comparatively short time the bottom layers might be forced out in a perfectly manageable condition.

Sludge as a Fertilizer

While indicating the possibility of freeing sludge in this way from a large proportion of its superfluous moisture, I am by no means sure that this would not be a step in the wrong direction. For the drying of sludge is merely a preliminary to its removal, and in no way solves the problem of its ultimate disposal. I cannot help thinking that the proper destination of sludge is the land, and if it can be applied to land within a reasonable distance, it is surely better to keep enough moisture in it to enable it to be forced through pipes (either by gravitation or by pumping) than to reduce it to a condition in which it must be carried. Apart from this consideration, it was shown by Dr. J. A. Voelcker, in his report of March, 1908, to the Royal Commission on Sewage Disposal, that a moist sludge is more valuable as a manure than a drier one.

In the disposal of sewage the avoidance of pollution must come first, and if it is a matter of choosing between adequate purification and crop production it is the crops and not the purification which must give way. But I am not convinced that these two desiderata cannot be reconciled. When our local authorities, quite properly, took the disposal of their sewage into their own hands, they had to buy land for the purpose. The acquisition of land for sewage disposal is a very costly business, and they, naturally, as a rule, bought no more than they could help. This land had, therefore, to be used to its fullest capacity for purification purposes, and the question of cropping had, necessarily, to go to the wall. But with fertilizers at their present prices, and the need for an increased production of food staring us in the face, ought we not to look into the matter anew, and see if a way cannot be devised for turning our sewage to useful account without detriment to its purification?

There must be within a short distance of many of our sewage works hundreds of thousands of acres of land which would benefit greatly from an occasional application of sewage, tank or filtered effluent, or sludge. Apart from the gain to the crops, the purification works, especially the filters, would benefit not a little from the partial or total rest which they would thus obtain.

The Future

I venture to think that none will quarrel with my description of the sewage problem as a many-sided one. And when we consider the many phases through which it has already passed, it is hard to believe that we have yet reached finality, or that the future has no more surprises in store for us.

Such being the position, it would seem to be wise to exercise strict moderation in our expenditure on works of sewage disposal. The present need must, of course, be met; and due provision should be made for the requirements of the immediate future. But we are not justified in spending large sums of money in anticipation of more distant needs when it is all but certain that before those needs arise more effective or more economical methods will be available. At the present moment, however, there is little danger of extravagant schemes being set on foot. It is more likely that urgently-needed work will be held up through the excessive cost of labor and materials. In some cases, I believe, the cost of a complete scheme of sewerage and sewage disposal would actually exceed the borrowing powers of the authority concerned. But ought a local authority to be permitted to perpetuate unsanitary conditions in a populous area by deferring badly-needed works of sewerage merely because it cannot afford the additional expense of laying down purification works?

Need of a Testing Station

Under normal conditions the amount of money spent every year on works of sewage disposal is very considerable. There are many available methods for the engineer to choose from. He needs reliable information to guide his choice. And when he has selected his process he requires reliable data upon which to design his works. There are, doubtless, some adventurous souls quite willing to experiment with new processes at the expense and risk of their clients. But the great body of engineers are conservative, and are not disposed to gamble with their clients' money and their own reputations by the adoption of methods with regard to which there is the least uncertainty. And so in default of reliable information concerning new processes, large sums of money are spent on lines which are admittedly not up-to-date, but which have, at all events, stood the test of time. A central testing station, at which new processes, precipitants, filtering materials, distributors, and all the other paraphernalia of sewage disposal, may be judged on their merits, is urgently needed.

The Massachusetts State Board of Health has for many years maintained such a station, the results of which have been freely given to the world. It is not creditable to this great and wealthy country, to which the question of rivers' pollution is more vital, probably, than to any other, that it should lag so far behind a little State with a population only half that of our own county of Lancashire. If for any reason the Ministry of Health do not see their way to take the matter up, the Engineering Standards Committee, which has rendered such valuable service in other directions, might fitly undertake the duty, in which case the Government should recognize the national importance of the work by aiding it with a substantial grant.

Late Registration Lost Privilege

Important Court Ruling in Appeal Case Defines Rights of Architects and Exercise of Privileges

A RULING under the law governing registration rights of architects' privileges against newly-constructed buildings; the drawing of a distinction between contracts actually completed and contracts validly abandoned at the will of the proprietor; and suggestions for amendment of the existing law as contained in a judgment of the Court of Appeal maintaining the appeal of George W. Cook from a judgment of the Superior Court, which had declared that a property now in his possession, and situated in St. Antoine Ward, Montreal, was affected by an architect's privilege in favor of John S. Archibald for a sum of $7,851.

The action, as entered in the Superior Court, by Archibald, was directed against James Maher, as defendant, and was based on articles 2013, and following, of the Civil Code, as amended by the statute, 7, George V., chapter 52.

Property Reverted

On October 8, 1912, appellant sold the property in question to Maher for $110,000. A cash payment of $20,000 was made on account, and Cook held a first mortgage on the property for the balance. It was decided by Maher to construct a ten-story building on the property, according to plans which were prepared by Archibald. On January 17, 1913, the builder's contract was awarded to C. R. Deakin, for $192,500, the building to be ready for occupation on September 15, following. In May, however, financial difficulties resulted in the building operations being suspended. In March, 1914, the building project was abandoned, and the property ceded back to Cook, who duly registered the title.

On April 13, 1917, Archibald registered his architect's privilege against the property for the balance of payment due to him for preparing the plans. Cook objected on the ground that Archibald's registration was too late; but the latter insisted that the construction work was not abandoned but was suspended, and he claimed his registration was valid in the light of the law, which allowed the architect to register his privilege within thirty days of the completion of the work for which he had prepared the plans.

The court of first instance upheld Archibald's claim on two grounds: First, that there was an irregularity in the deed under which the property was ceded back from Maher to Cook; and, secondly, because Archibald had the right to establish, and did establish, his privilege "before the expiration of thirty days after the end of the work."

The Governing Law

Mr. Justice Carrol, in delivering the court's unanimous judgment, maintaining the appeal and dismissing Archibald's action with costs, said it would not be necessary to discuss the question of law raised on the first point of the judgment appealed from, as respondent did not take up any position upon it. Passing then to a discussion of the law as it was to be applied to the respondent's privilege claim, and assuming that an architect had a privilege pending the duration of the works without registering his claim, Justice Carrol said: "It is none the less certain that once the works are completed he must register his privilege within thirty days of the date upon which the building is ready for the use for which it was destined. The amendment effected by the statute 7, George V., chapter 52, article 2013F, has not in this respect changed the rights of the architect; but the proprietor is master, and if he so desires he may put an end to his contract with the builder. That is decreed by Article 1691 of the Civil Code. Naturally, in such an event, if the parties affected do not come to an understanding, the proprietor will be obliged to pay damages according to the circumstances of the case. Can the proprietor agree with the contractor to put an end to the contract on conditions entered into between the two parties? Our article 1691, differs from the corresponding article of the Code Napoleon (1794), in the sense that, under our law, the proprietor is obliged, if it is the case of the exercise of his own will, to pay damages according to the circumstances of the case, whereas in France the proprietor is compelled to indemnify the contractor for all expenses, for all his labor, and for all the profits he may have gained from the enterprise. That disposition of the law is exorbitant of the common law. As a general rule it is not permitted to put an end to a contract at will, but this extraordinary disposition is based on equity.

The Law of Equity

"As a matter of fact, after the commencement of the works, the proprietor may find himself in financial difficulties, or he may realize that the enterprise is not likely to bring him the profits he had calculated upon in the first instance. It would be unjust to force him to continue a work which would result in his ruin. I believe, however, that our article in no event allows a scrutiny of the motives of the proprietor. He may end the contract by mere caprice, provided that he pays the damages which are allowed by the circumstances of the case. It belongs to the court to estimate those damages according to the good or bad faith of the proprietor.

"In this case conditions made by the contractor for the continuation of the works were not fulfilled, and the contract was ended on March, 1914. The architect had thirty days counting from the date just named to register his privilege. He did not register it until 1917, after the property had passed back into the hands of the first vendor. It is true that under Article 2013 of the Code he has a right to register the privilege within thirty days of the date on which the construction is completed for the use to which it was destined, but that article has in view an "executed contract," and not a contract which has been ended either by the will of the parties to the contract or by the will of the proprietor, as the law of the article I have already cited permits.

Suggested Amendment

"This case suggests an amendment which it would be very important to introduce into our Civil Code. Before the Anger law, the privileges of architects, builders, workmen, and furnishers of materials had to be registered before the works commenced. A clause was drawn up establishing the condition of the place, and after the completion of the works a second clause was drafted establishing their value. The principle of our legislation is that all real rights must be registered. However, the privileges I have just mentioned exist, under the new legislation, without registration, whereas the old law exacted publicity. Under the new legislation the work of the construction of a building may last two or three years, and during that time a crowd of privileges will exist without registration, so that the property may in a way be considered out of the market, for no buyer or lender will transact business with the proprietor for fear there are privileges existing on the property which do not appear in the registration office. They would not run the risk of advancing money on a surety so fragile. It seems to me, therefore, that an amendment might be introduced into the existing law, which would conserve the privileges which already exist without sacrificing the credit of the proprietor. It would be necessary only to modify the mode of publicity if the ancient mode appeared defective. So that anybody could go to the registration office and transact business, knowing if any privilege of any kind affected the property.

"In this case now in appeal I am of opinion to reverse the judgment a quo and dismiss the action, with costs."

Registration Was Tardy

Mr. Justice Greenshields: "If an architect knows that the construction of a building for which he has prepared plans and specifications has been abandoned, either owing to the impossibility of the proprietor to construct it, and knows that it never will be constructed, I do not believe that architect may wait for four years until the property has passed, for value, into the possession of an innocent third party, and then make known, by registration, a claim against that property, the existence of which the innocent holder had no notice. I have no doubt the respondent at one time had a privilege upon the property for something; but I have no doubt that he lost that privilege by his tardy registration."

Hints for the Contractor

That May Save Him Time and Money—We Will Pay for All Accepted Items—Send One In

A 140-Ft. Concreting Tower Raised into Place in One Piece

POSSIBLE interference of guy lines with the excavating and piledriving operations in the construction of a marine way for the Carnegie Steel Co. at Coal Valley, Penn., forced the contractor to raise complete in one piece the 140-ft. wooden concreting tower which was required in subsequent concreting work.

A permanent foundation for the tower was built in its proper place, made up mainly of two long timbers laid on the ground and anchored firmly with a spacing equal to the width of the tower. Two more timbers were laid across these and bolted to the first two to serve as the horizontal legs which were used in the tower in place of guys. The tower was then built up horizontally and laid along a line normal to the shore line, with its base tight against the foundation timbers, which were used also as a heel of the raising. To stiffen the tower in the raising operation steel cables were trussed along the lower side.

A heavy ginpole 50 ft. high was then set up at the shore end of the tower, and lines were rigged with block and fall to the top of the tower. When the time came for raising, two derrick boats with 75-ft. booms were set at the shore line, and boomed up as high as possible.

The fall lines from these derricks were made fast to a timber that was placed near the top of the tower so as to distribute the strain. The tower was first raised by means of the ginpole until it had made an angle of about 20° with the horizontal, when the derrick boats took the strain. Block and falls from the ginpole were then cut loose, and the tower was raised to its vertical position by the derrick boats. During the raising, the guys which had been made fast to the top of the tower while lying down were paid out from snubbing posts and kept tight enough to hold the tower in line in the line of the derricks. Exactly 35 min. elapsed from the time when the tower left its horizontal position until it was erect in place.

The work was done from the Pittsburgh office of the Foundation Co., of which H. B. Kelsey is district manager.

Keeping Scrap Cleaned Up Saves Money

SALVAGE of all discarded materials, says J. W. Radford, makes workmen more careful of machinery and economical of repair parts. Mr. Radford, who is superintending the construction of about 5,000,000 cu. yd. of levees by walking draglines in the Inter-River Drainage District in Missouri, believes that it is economy for the contractor to keep scraps of iron, such as broken machinery parts, cleaned up and disposed of, and not allow these to be thrown away along the right-of-way of the work. It is his opinion that a failure to salvage broken parts tends to carelessness, on the part of the workmen, with machinery and repair parts. It is not uncommon to walk along work where a dragline or dredge has passed and find broken parts left to rust. A wornout bucket discarded on top of a spoil tank is not an unusual sight. Mr. Radford thinks it better to collect this scrap-iron and haul it where it may be sold or otherwise disposed of, even though doing so apparently costs more than to throw it away. A teamster can do this work at odd times, when he would be doing little work of any sort, and thus it really costs very little. The profit comes in the spirit which is instilled into the employees who go about their work with more care and appreciation of the value of the machines they are operating.

Charging Off Depreciation on Contractors' Equipment

INSTEAD of the straight-line method of estimating depreciation on equipment, whereby a constant percentage of the first cost, dependent upon the probable length of life of the machine, is charged off each year, another plan of estimating depreciation was contained some time ago in a news letter of the Associated General Contractors of America. This plan was submitted by one of the association's members.

According to this contractor's method, the percentage charged off annually is based on the book value of the piece of equipment, so that normally the depreciation becomes less and less year by year, and the machine is always valued at some figure, until scrapped. However, the percentage adopted for any particular year will vary with the usage to which the equipment has been subjected, and one year it may be 30 per cent. and the next 20 per cent. For example, a concrete mixer worth $3,000 new might be carried on the contractor's books at $2,100 after a year of hard service, and $1,680 a year later if it was not used extensively the second year. By this method the greatest depreciation is considered to occur during the first year if the rate of usage of the mixer be constant.

This is consistent with the fact that when a new machine is used it immediately becomes second-hand equipment and usually loses considerable value if put up for sale.

There are advocates of this method of handling depreciation, on the ground that the depreciation charge plus the cost of repairs should be a constant value for each year that the equipment is in use, and, since repairs become heavier as the equipment becomes older, depreciation should decrease correspondingly. For the purpose of computing rental charges, however, difficulties are brought in by the assumption of a variable depreciation rate, since it is the average annual depreciation, after all, that would ordinarily be considered in fixing rentals.

In most cases where equipment is rented, the work is on a cost-plus basis and the fixed fee or percentage paid the contractor does not depend upon the rental of the equipment.

However, on some cost-plus work the rental charges are included in the sum on which the percentage is paid, and in such cases the rental rates quoted are reduced sufficiently to bring in approximately the same sum as when the profit fee is independent of the charges for use of equipment.

On lump-sum contracts, no attempt is made to carry equipment rentals on the payroll for the job. All charges against plant are handled in a separate account, and the proper share of the annual depreciation is charged to each contract.

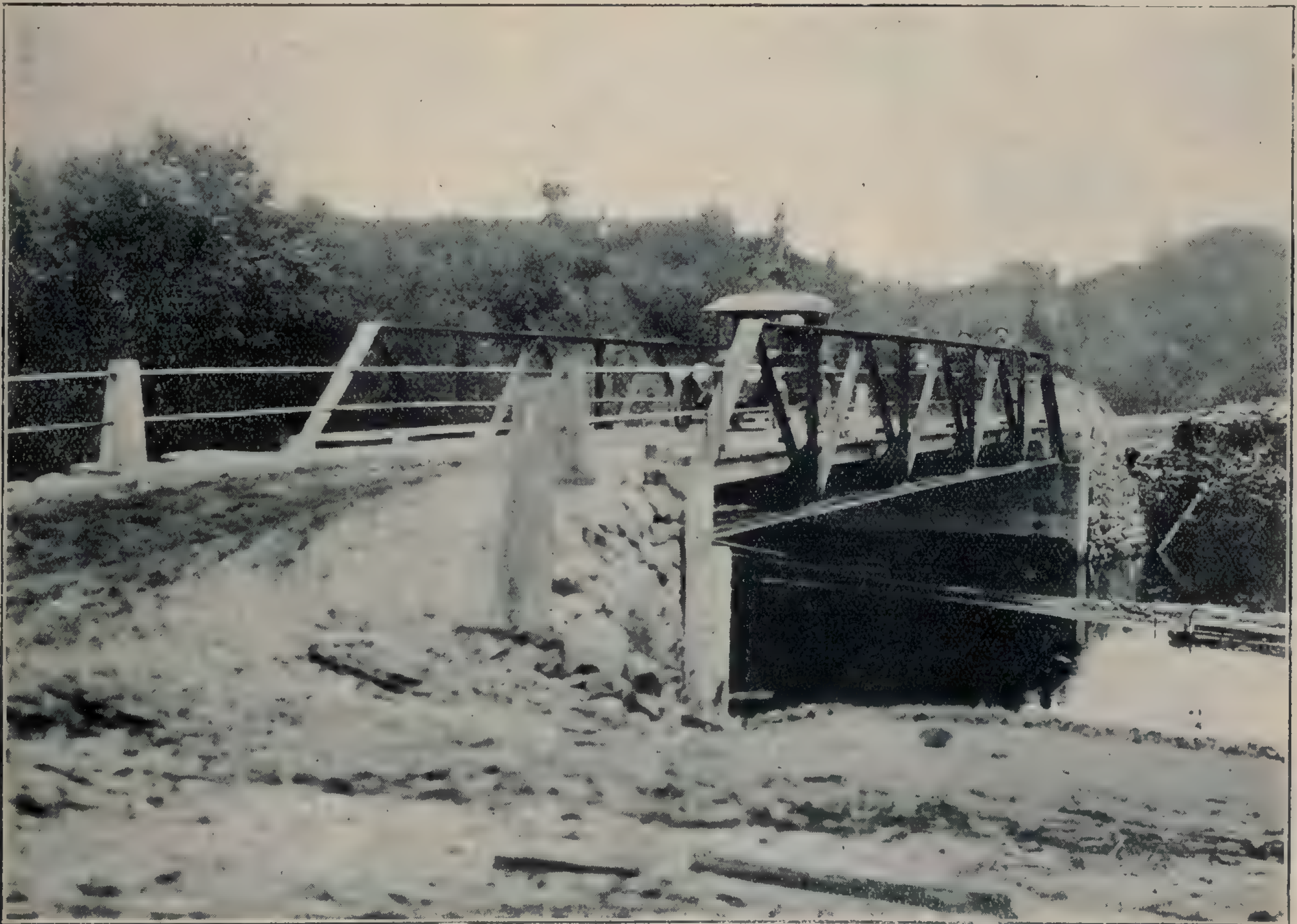
Rental of equipment is paid for each calendar day between the date when the equipment is loaded at the storehouse of the contractor and the date that it is loaded for return. Transportation charges both ways and all current repairs are also included in the sum paid to the contractor for the use of equipment. Small tools, when new, are charged to the job and then taken back at a fair valuation when the contract has been completed.

Senator J. P. B. Casgrain has been appointed third arbitrator in the controversy over the La Salle Bridge, Montreal. The two other arbitrators are; for the city, Mr. J. Emile Vanier, C. E.; for Messrs. Pion, Grothe and O'Sullivan, Mr. F. C. Laberge, C.E. There is a dispute as to the damages, if any, to be paid to Messrs. Pion, Grothe and O'Sullivan for the construction of the bridge. The contractors did not carry out the whole of the work, which was completed by the city.

Sixteen Storey Hotel Permitted in Montreal

By a majority of three, the Montreal City Council have adopted a resolution favoring the building of a sixteen story hotel, recently referred to in our columns. This action was taken on the recommendation of a committee of the council who suggested that the administrative commission be requested to amend the by-law regarding buildings to allow the erection of buildings over ten stories in height. The chief argument in favor of the recommendation was that the cost of land in the city is so high that it is impossible to erect a ten story hotel and secure an adequate return on the capital. Against this it was argued that large buildings would lead to a congestion of traffic, and that they would involve greater expense in affording water service and fire protection; further, that the trend of opinion in cities where these sky-scrapers were erected was now against the construction of such high buildings.

Type of Bridge Used in Quebec Province for Light Traffic



Bridge near Moulin Naud, on the Jacquot River, at Ste. Christine, County of Portneuf. A free span of 67 ft. 4 in. This bridge was built in 1918. It is in a remote district with only light traffic.

Report on Coal Production

Canada's production of coal and coke during the calendar year 1918 is covered in a report issued by the Mines Branch of the Dominion Department of Mines. It is by John McLeish, chief of the Division of Mineral Resources and Statistics.

Mainly Constructional

East and West—From Coast to Coast

Building permits issued in Prince Rupert during 1919 approximate $360,000 in value.

The water commission of St. Thomas, Ont., will spend $50,000 for new pumping station equipment.

The Housing Commission of Owen Sound, Ont., will ask the Provincial Government to provide them with $200,000 in order to carry on housing operations.

The City Council of Windsor, Ont., has gone on record as favoring the new million dollar hotel to be built there, and has granted a fixed assessment of $100,000 for ten years.

It is stated that a highway bridge, costing some $200,000, will be built over the St. John river, between Edmundston, N.B., and Madawaska, Maine. This new structure will connect new highways recently built in Quebec, New Brunswick and the State of Maine.

In the report of the general manager of the Toronto Board of Education, in regard to a building policy for the coming year, it is recommended that seventy-five additional class rooms be provided, divided among 28 schools of the city, at an aproximate cost of from $1,200,000 to $1,500,000.

It is reported that the Ontario Government proposes to solve the Provincial Highway controversy by constructing two roads between London and Windsor—one along the Longwoods road through Chatham, thence through Raleigh township to Tilbury and on to Windsor; the other following the Talbot road through St. Thomas.

The High School Board, of Sault Ste. Marie, Ont., has asked the city council for $300,000 for building purposes during the coming season. It is planned to build an extension to the High School costing $190,000, and to build a technical school costing $222,500. The Provincial Government has agreed to contribute to the cost of the technical school

In Vancouver during the past year there were 461 building permits issued, representing an estimated value of $1,297,171, which is an increase of more than $1,000,000 over the 1918 total. The report of the building inspector, Mr. James Hughes, shows that permits were taken out for 288 dwellings, five factories, five public buildings and 163 garages.

Building permits issued in Regina, Sask., during 1919 reached an approximate value of $1,699,020, distributed as follows: New dwellings, $539,870; warehouses, factories, etc., $307,300; public garages, offices and stores, $133,900; theatres, schools, etc., $516,300; apartments and terraces, $99,000; private garages, $9,735; stables, $4,200; removals and alterations, $57,015; miscellaneous, $22,700; total, $1,699,020.

Building operations are to be commenced next month in connection with the two-million dollar addition to the King Edward Hotel in Toronto. The new building is to be 16 storeys in height and contain 500 rooms. Its equipment will be very elaborate and complete. Six passenger elevators will be installed and on the top floor will be arrangements for a combination roof garden, convention and banquet hall with a capacity for 2,000 people. The laying out of the site will involve the widening of Leader Lane.

At a recent meeting of the Guelph Builders' Exchange, communications were read from several of the trades unions intimating that demands would be made in the near future for higher wages and shorter hours. A letter was also read from the Ottawa Exchange, suggesting that action be taken with a view to standardizing the wage scale throughout the province, thus preventing men from jumping from one town to another. No action was taken by the Guelph Exchange on this suggestion. The Exchange proposes to hold a banquet in the near future, and a special committee, with A. W. Reynolds as chairman, has been appointed to make the necessary arrangements.

The report of the Building Inspector for York Township, Ont., regarding the work carried out during 1919 shows the following figures: 1,498 dwellings, estimated cost, $3,333,300; 787 additions and alterations, estimated cost, $293,465; 52 stores, estimated cost, $152,800; 2 schools, estimated cost, $232,000; 353 garages, estimated cost, $83,100; 4 store houses, estimated cost, $58,300; 1 bank, estimated cost, $19,000; 2 apartment houses, cost, $32,000; 3 coal sheds, estimated cost, $12,500; 16 stables, estimated cost 8,960; ated cost, $1,100; 1 church, estimated cost, $8,000; 1 hall, 2 workshops, estimated cost, $4,800; 2 greenhouses, estimated cost, $1,100; 1 church, estimated cost, $8,000; 1 hal,, estimated cost, $1,000; 3 removal of buildings, estimated cost, $800; total, $4,241,125. The total number of permits issued was 2,186. In the month of December alone the value of the buildings for which permits were issued was $143,150, the number of permits issued being 45.

Personal

C. H. Scheman, general sales manager for Canada, Canadian Chicago Bridge & Iron Co., Chicago, has opened an office at 260 St. James St., Montreal.

The report regarding the resignation of Mr. E. R Gray as City Engineer of Hamilton, Ont., was in error. Mr. Gray does not intend to resign, but has been given two weeks leave of absence for the study of asphalt paving in Toronto and Detroit.

Mr. W. G. Swan has been appointed chief engineer in connection with the Vancouver Harbor Improvement by the Vancouver Harbor Commissioners. Mr. Swan is a member of the Engineering Institute of Canada and holds the degree of B. A. Sc. and C. E. of the Faculty of Applied Science and Engineering of the University of Toronto, where he also acted for two years as demonstrator and lecturer on mechanics of building materials. In 1903 Mr. Swan was hydrographic engineer for the Dominion government, and the following year joined the engineering staff of the Canadian Northern Railway, working his way up through the various engineering capacities—residence, bridge, divisional, terminal—to the position of district engineer. Mr. Swan was also in charge of the Pacific Coast Mainland terminals for three years previous to the war, during which time he designed and superintended the construction of the Port Mann wharves. The reclamation of False Creek Mud Flats was another undertaking of which he had charge. Mr. Swan was in the army for three and a half years and saw two years' service in France.

Obituary

Mr. William Ross, general superintendent of the Phoenix Bridge and Iron Works, Montreal, died very suddenly on the 11th inst. Mr. Ross' death is believed to have been due to heart failure, which took him just as he had left his office. He was 69 years of age.

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Organized Co-operation Will Harmonize the Construction Industries

IF the building and construction men of Canada have any belief in organization, let them organize now. There is no time like the present and the coming conference of the Association of Canadian Building & Construction Industries presents the opportunity which they require. The Association, thought it has not reached its final form of organization, represents a large expenditure of time, energy and money. In it, the contractors and supply men of Canada have the construction plant and building materials out of which they may erect an edifice worthy of the great industry to which they belong. If they refuse to use it they scrap a valuable outfit, and all the effort and expense which have been used in bringing the Association to its present stage will be wasted—and waste in these days is criminal.

Some seem to think organization talk is all piffle. And yet they live by organization. The human body is an organization, in which if any of the members refuse to co-operate, serious trouble results for the individual. Civilization itself is an organized co-operative society, and each one of us every day depends on the co-operation of thousands, or hundreds of thousands, of men and women, for our food, for our clothing and for the countless comforts and conveniences which have come to be regarded as necessities of life. A one day's strike of all these people, on whose co-operation we depend, would bring us to the verge of famine and starvation. If, then, organized co-operation is the basis of civilization, it follows that the higher the organization and the closer the co-operation, the more efficient will our civilization be. This organized co-operation will harmonize our industries, decrease their troubles and increase their production and their profits. Then let us not fall behind. Let us have it to the fullest extent in the building and construction industries. It will mean some effort; a big flywheel takes considerable energy to start, but once it gets going—. And that's what the A.C.B.C.I. will mean to us, once it is properly organized and set in motion.

Lack of Town Planning Scheme Will Handicap Montreal's Development

TOWN planning and the general well being of the community from the health point of view were the main topics of discussion at a recent session of the Social Service Council Congress in Montreal.

Col. John Amyot, M.D., C.M.G., Deputy Minister of Health for Canada, presided over the session, and in his opening remarks showed the character of the work of that department, which came into existence last June. Among matters under its supervision was that of foods and drugs.

In speaking on town planning and community development, Mr. Thomas Adams urged that there should be applied to our social and industrial organization the same degree of science and thought that had been so sucecssfully applied to the processes of manufacture. Commenting upon Montreal, he said: "Here we have a city of nearly 700,000 inhabitants, with an area of 32,155 acres, grown since 1891 from 219,600 inhabitants and 8,166 acres. Its area has grown more rapidly than its population. In the not far distant future it will have two million inhabitants, covering at least three times the present territory, and will be wrestling with the curing of evils that we can prevent without cost to-day by the exercise of foresight. One thing makes it uncertain that Montreal will grow much further unless it is planned. Manufacturers are either leaving Montreal, or ceasing to come within its boundaries to the degree that they have in the past. Modern convenience of transportation and power distribution have greatly accelerated that movement, but it began because of land speculation and want of planning, with consequent high taxes, congestion and bad housing. Montreal is probably the only city of its size on this continent that has no city planning policy or project. It will have to compete in the future with the cities of Boston, New York and Chicago, which are being comprehensively planned; also with the cities of Britain and France, which are compelled to prepare plans under state legislation in the next few years. If the governments, provincial and municipal, were prepared to place themselves on the same level as the best manufacturers we should have a community development that would be years in advance of what we have now."

Dr. W. H. Atherton put forward a resolution in favor of asking the Quebec Legislature to go forward with town planning projects, but on the suggestion of the secretary, Rev. T. W. Davidson, this was withdrawn on a promise that it would be dealt with by the Quebec Provincial Social Service Council.

Ontario's Highway Policy Outlined at Motor League Meeting

AMONG the speakers at the recent annual dinner of the Ontario Motor League were Hon. F. C. Biggs, the new Minister of Public Works and Highways for the Province of Ontario, and Mr. A. W. Campbell, Dominion Highways Commissioner. The burden of Mr. Biggs' message was "good roads for everybody," and his remarks were very favorably received by the motorists. "Only conditions over which we have no control will retard the making of first-class roads in this province," he declared, "but you don't only want roads for motorists. You want roads for everybody. You want production from the farms, and also roads for the delivery and distribution of your manufactured goods throughout this Province." The speaker was convinced that the road policy for Ontario should be one fairly and squarely balanced for every ratepayer, be he large or small. "I have tried," he said, "to work out a road policy for Ontario which will play fairly with and bear fairly on all the different sections and classes of the people. The late government laid out 422 miles for provincial aid and called them provincial highways. I think this is a first class idea, but I do not think they went far enough, because under my plan I'd like to increase this to 1,600 miles.

Patrol System

"What I would like to see instituted in this Province is a patrol system on every country road, with piles of material of different natures, different sizes, at convenient distances along these country roads and along the Provincial highways, so that when depressions come in the road they will be immediately arrested and filled."

The Minister believed that good roads would prove a factor in reducing the high cost of living, but they didn't want trunk roads alone, but also feeders and good feeders. The three outstanding essentials for rural development were: better educational facilities, good roads and development of the Hydro power and light service. In regard to the Hydro radials, the speaker said they should be very careful in regard to duplication with existing railways.

A point emphasized by Mr. Biggs in connection with the Provincial highways programme was that they did not want to make any more detours than was absolutely necessary. He did not want to see traffic crowded out on township roads or county roads and these roads all torn to pieces, while the government was trying to build its provincial highways.

The speaker also made reference to the evil of glaring headlights and declared that a solution must be found for it in the Province of Ontario.

Mr. A. W. Campbell, Dominion Highways Commissioner, dwelt on the need of concentrated attention upon highway improvement work, as related to efficiency in transportation. "There can be no doubt about it," he said, "that the question of road construction is one that is not receiving all over Canada the amount of careful thought which it really involves." Canada had an automobile population of 300,000, valued at $300,000,000, and he estimated that good roads might save motorists $70,000,000 a year. However, every province was taking a very enthusiastic interest in the question of road improvement and all of them were trying, as Ontario was, to devise a somewhat general plan which would single out the important roads and classify the less important ones. With the completion of some such nation-wide plan, it should be possible eventually, with Dominion assistance, to reach almost any place in Canada over well-improved roads.

As to the class of roads to be built, it would be wasteful to build a concrete road on a back-township line, but it might be just as wasteful to construct on a heavy traffic highway a road such as was suitable for a back-township.

The motor truck, the speaker pointed out, was fast developing, and he believed its use in connection with the handling of farm products would be one of the most useful developments in connection with the industry.

Road Development in Northern Ontario

Hon. Beniah Bowman, Minister of Lands and Forests, spoke of some of the "Good Roads" plans in Northern Ontario. He said that by July, 1921, they hoped to have the trunk road from Sudbury to the Soo completed, and also to have the road from Toronto to North Bay to Sudbury in fairly good shape. He expected, too, that they would have the roads on Manitoulin Island in better condition in a short time. "They were trying," he declared, "to get roads throughout Northern Ontario so it would be possible to go in a motor anywhere in that country. The problem, however, was complicated, and there were many demands from the settlers where they had no roads at all.

Mr. S. L. Squire, President of the Canadian Good Roads Association, emphasized the fact that some roads must receive a much larger share of the expenditure and attention than others, due to their greater importance. Twenty per cent. of the roads in Ontario, he said, carried 80 per cent. of the traffic. Consequently it would be equitable to spend many times the amount on these than on the roads on which the traffic was light.

Mr. Squire also extended an invitation to those present to attend the annual Good Roads Congress, which is to be held in Winnipeg the first week in June.

Hon. F. C. Biggs, Ontario's new Minister of Public Works and Highways, states that trucks and crushers are on the ground ready to start work on the Brantford-Hamilton section of the Provincial Highway as soon as the frost is out of the ground. The road will be resurfaced with macadam, he states, and it is expected that by the fall the twenty-five miles of roadway will have been completed. The highway between Brantford and Paris and on to London, is to receive the same treatment, but the Minister does not state when it will be done.

Canada's Engineers—Dr. Geo. G. Nasmith

Dr. Geo. G. Nasmith, one of the three members of the recently organized firm of consulting engineers, Gore, Nasmith & Storrie, Toronto, was born on the last day of the year 1877, in Toronto. After passing through public school, he attended the Jarvis Collegiate Institute, then known as the "Old Grammar School," from which he graduated in 1896. He then entered the University of Toronto, where he took up the natural science course, specializing in geology, chemistry and mineralogy, and from 1900 to 1902 took a post-graduate course in science and physiological chemistry. Having obtained his Ph.D. and M.A. degrees, Dr. Nasmith, in 1902, joined the staff of the Ontario Board of Health as a chemist under Dr. Amyot. During the next eight years, he wrote some of the papers which brought his name into prominence in the scientific world. Among the subjects he dealt with were coal gas poisoning and water sterilization. A paper of his on water sterilization was reproduced in the Royal Army Medical Journal, and the method recommended has since been adopted in many places throughout the world. In 1910, Dr. Nasmith was appointed director of the laboratories of the Health Department of the City of Toronto, and in this capacity introduced chlorination of the water supply at the time of the break in the intake in 1911, as a result reducing the typhoid death rate from 42 to 20 per 100,000—a figure which has since been reduced to 2 per 100,000. Dr. Nasmith was also chiefly instrumental in bringing about the elimination of excess water from the milk supply of the city of Toronto. Another of his achievements is the invention of the brush trickling filter for sewage disposal plants. In 1914 Dr. Nasmith went to Valcartier as head of the Hydrological Corps, in charge of water supply, and then went overseas as sanitary adviser to the first Canadian Expeditionary Force. His portable filtration and sterilization unit was adopted by the British War Office, and he was sent to France with the rank of colonel, in charge of the Canadian Mobile Laboratories attached to the First British Army. It was Dr. Nasmith who discovered, at the second battle of Ypres that the gas being used by the enemy was chlorine, and he produced an antidote and devised a gas mask. For these and other services, he was invested with the Companionship of St. Michael and St. George. Returning to Canada in 1917, the honorary degree of D.Sc. was conferred upon him, and last year he obtained the degree of D.P.H. at the University of Toronto. Dr. Nasmith's resignation from the service of the City of Toronto took effect at the end of last year. He has now taken up his new responsibilities with the firm of Gore, Nasmith and Storrie, and is working upon a solution of the sewage sludge problem.

Dr. Geo. G. Nasmith

Architects of Quebec Discuss High Buildings

AMONG the important matters discussed at the twenty-ninth annual meeting of the Architects of the Province of Quebec, at Quebec, was the projected construction of a sixteen-story hotel in Montreal. A resolution was passed and forwarded to the Private Bills Committee of the Provincial Legislature, also to the Board of Commissioners of the City of Montreal, in which the Association placed itsself on record as being unanimously opposed to the erection of a sixteen-story building. One of the principal arguments advanced in the resolution is that the average street in Montreal is not more than 66 feet in width, while the by-laws at present limit the height of buildings to 130 feet or about 10 storeys, which is practically twice the width of the average street and the architects contend that it would not be wise to go beyond this.

A lecture was also delivered by Mr. I. G Smith, Dominion Fire Commissioner, in which he quoted statistics to show that in 1918, Canada had sustained a fire loss of eight dollars per capita against forty five cents in England, thirty-nine cents in France and fourteen cents in Belgium. He suggested as a remedy, a better education of the people in fire prevention, also the remodelling of the building by-laws throughout the country.

Later a delegation of architects waited on Hon. A. Galipeault, Minister of Public Works, urging the Government to revise the by-laws regulating the construction of public buildings. It was also suggested that in future, all public buildings of any importance be built of fire-proof or at least slow-burning materials.

The election of officers resulted as follows: President—Mr. Norman McVicar; 1st vice-president—Mr. Eugene Payette; 2nd vice president—Mr. L. Auger; secretary—Mr. Joseph Perrault; treasurer—Mr Melville Miller; councillors—Messrs. A. Champagne, C. McDougall, H. Racine, Prof. R. Traquair, Ernest Cormier; delegates to the Royal Architectural Institute of Canada—Messrs. A. Chausse, J. Perrault, Prof. R. Traquair, Jos. P. Ouellet, and J. S. Archibald.

Visitors will get a hearty welcome at the convention of the Provincial Builders' & Supply Association at the King Edward Hotel, Toronto, Feb. 10-11-12. Come whether you are an Exchange member or not?

Front Street Bridge at Thorold, Ont.

Steel Railway Span Erected Amid Difficulties Owing to Need of Maintaining Traffic Over and Under Structure

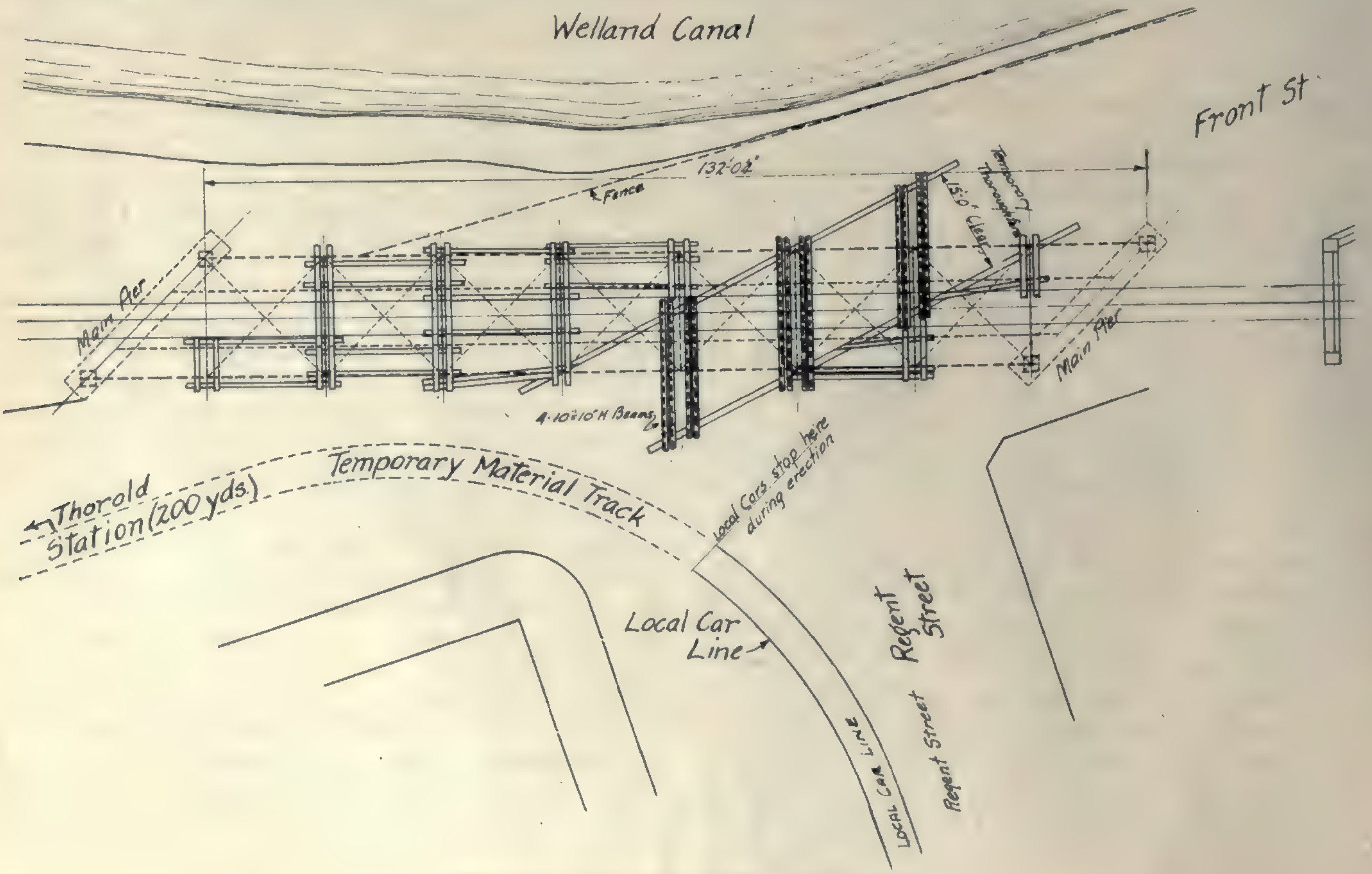
By W. C. MacKinnon*

During the past summer the Niagara, St. Catharines & Toronto Railway, a part of the Canadian National Railway system, replaced the old pin-connected truss span over Front street in the town of Thorold, Ont., by a modern rivetted truss span. The design of the bridge was much complicated by the heavy skew and by the necessity of keeping the grade at its old elevation, making use of the existing piers, and at the same time avoiding any reduction in the clearance over the roadway. With this latter object in view, it was found advisable to place the floor system beneath the bottom chords. The end floorbeams were supported on ordinary pier members at 21 ft. 5⅞ in. centres on the skew. These floorbeams carry the main trusses on cantilevered ends at 24 ft. 3⅞ in. centres, also measured on the skew, and are so close to the base of rail that it was found necessary to fan the two end panels of ties.

The erection was a very difficult proposition owing to the need of maintaining frequent traffic over the bridge, and not blocking the surface roadway traffic which was heavy. It was further complicated by the existence of electrically charged wires on both lines. Owing to the tracks of the street railway running so close to the bridge, it was found impossible to safely maintain this service and it was thought best to stop the cars at the foot of Regent street during erection, instead of running them on into Thorold which was only about two hundred yards away. The section of track in temporary disuse in this way was used for unloading material at the site and was very convenient, the material cars being switched on to the street car line at Thorold station.

Traveller on Top Chord

With a view to minimum inconvenience both to railway and street traffic, and to maximum safety of life and property during the work, it was decided after a thorough study of the difficulties to be overcome to use an overhead traveller, running on the top chords of the new span. It was thus not necessary to make any use of the tracks, everything being at all times clear from the rails to the trolley wire. The traveller was built of timber, on four trucks with two wheels per truck, and equipped with two 40 ft. booms of 10 in. by 10 in. yellow pine. It was erected on a tower at the Thorold end of the bridge, and on a level with the new top chord, ready to begin work before any steel in the old bridge was disturbed. It was decided that sufficient time could be secured between trains to remove a complete panel of stringers and a floorbeam of the old bridge and replace with a corresponding panel of new steel with ties framed in place in one operation. A switchman was placed



Plan view of Front Street Bridge at Thorold, Ont.

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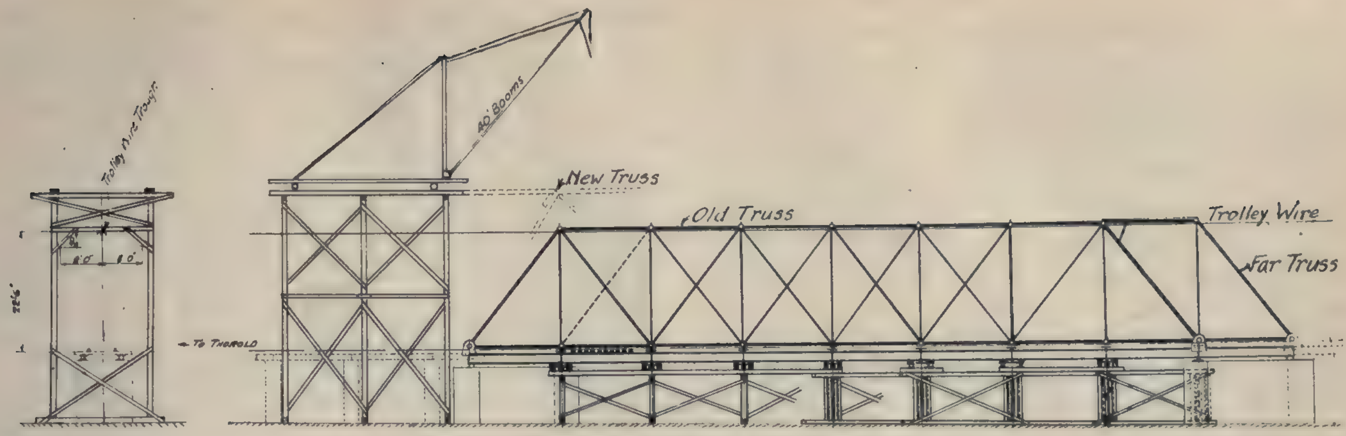
*Assistant Engineer, Dominion Bridge Company.



Erection methods on Front Street Bridge, Thorold, Ont.

at either end of the bridge to shut off the current while this work was going on. The truss members and bracing were then filled in, the traveller moved ahead and made ready for removing the next section of floor.

The new bridge was designed by Lt.-Col. C. N. Monsarrat, consulting engineer, Dept. Public Works, Ottawa, for the Canadian National Railways; Mr. W. P. Chapman, Bridge Engineer. The chief dimensions of the span are: c. to c. of end bearings 132 ft. 0¼. in ; width c. to c. of trusses 17 ft. 6 in.; height c. to c. of trusses 28 ft. The fabrication and erection was undertaken and successfully carried out by the Dominion Bridge Co., Ltd. with Mr. E. S. Houck as foreman in the field.

Eastview Gets Water Supply from Ottawa

$65,000, Spent to Lay Mains Connecting to Capital City's System — Sewage Disposal Scheme to Follow

THE town of Eastview lies adjacent to and on the east side of the city of Ottawa, from which it is divided, on the west side by the Rideau River and on the south side by Beechwood Avenue, the north side of the street being in Ottawa and the south side in Eastview. The town was incorporated some ten years ago, with an area of 700 acres, and it now has a population of almost 5,000.

Until this year the town had no water supply, being dependent on private wells, and has had to depend for fire protection on a Lafranc twin chemical engine. The town council from time to time have considered a water supply, but knowing that eventually Eastview would be annexed to the City of Ottawa they have always been shy of sinking a large sum of money in a water system, which, when annexation came about, would, in all probability, be scrapped. They had approached the Ottawa Board of Control on several occasions regarding an extension of the Ottawa mains into Eastview, but had always met with the reply that Ottawa could handle no more than they had, until the city overland main was completed.

City System Extended

As this overland water main was completed last winter, the Eastview council thought it an opportune time to again press their request on the city. This was done early last summer and an agreement was entered into between the city and the town, whereby the city agreed to supply the town with water, with a minimum supply of twelve million gallons for $2,000, and 16 cents per thousand gallons for all used in excess of the twelve million. In addition thereto the city stipulated that all the water mains in Eastview were to be laid by them under the superintendence of the city commissioner of works, and all material and fixtures to be the same as those used in the city's system, so that in the event of Eastview being annexed at any time, the Eastview system would automatically fit in with the city's system.

As a start this year, it was decided to instal a 12-inch water main through the heart of Eastview, which would act as a feeder for the whole town, and which could be tapped in future years for the side streets as required.

The city of Ottawa has a fifteen-inch main on Beechwood Avenue and a fifteen-inch main running down to the easterly end of Rideau street to the edge of the Rideau river. The suggested route for the Eastview main was from the corner of Beechwood Avenue and McKay street, connecting a twelve-inch main there with the city's fifteen inch main, running down McKay street to Catharine street, along Catharine Street to Marier Avenue, along Marier Avenue to the Montreal Road and along the Montreal Road to the east side of the Rideau River. and then taking it under the river and joining on to the fifteen inch Ottawa main at the foot of Rideau Street. Meters were to be installed at the two places where the city's mains were tapped.

Estimates of Cost

The total length of this main was 8,800 feet and along the route were some 160 residences, which could be served with water and from which the town, through water rates, could derive a source of revenue to offset the annual payment of $2,000 to the city of Ottawa.

For fire protection it was decided to install fifteen 3-way hydrants along the route, which number will be augmented on the side streets as they, in future years, get their extensions.

The estimate for this work was:

Excavation and Refilling.		
Rock—1,800 cu. yds. at $4.50 per cu. yd.	$8,100.00	
Earth—7,000 cu. yds. at $1.50 per cu. yd.	10,500.00	
		$18,600.00
Cast Iron Pipe.		
8,800 lineal feet of C. I. pipe at $3.70 ft.		32,560.00
Labor, laying C. I. pipe at 25 cents per ft. (including pig lead)..		2,300.00
Hydrants.		
15 three-way standard fire hydrants, installed with valves at $175.00		2,625.00
Valves.		
8 standard 12 in. gate valves, installed complete at $150.00		1,200.00
Cast Iron Specials.		
16 single branches at $30.00 each.....	$480.00	
6 double branches at $40.00 each.....	240.00	
Bends, sleeves, reducers, etc.	280.00	
		$ 1,000.00
Lead Services.		
170 service connections to houses could be installed at $40.00 each		6,800.00
		$65,085.00

The town proceeded to issue debentures to pay for the work under the provisions of "The Public Utilities Act," and the work was started late in July, and is now completed.

The twelve inch main was laid at a depth of 6 ft. 6 in., along the whole route and though no rock was met with, the whole distance, however, was a hard slate shale and proved bad digging. In no spot along the whole route was the excavating easy.

In spite of this, under the able superintendence of the city's commissioner of works and his assistants the whole system was installed in three months and at a figure considerably below the estimate.

There is no doubt that, this year, the water system will be further extended throughout the town, as already numerous applications are coming in from side streets for water service.

Eastview has no sewerage system, but now that the water service has been brought into the town, sewerage disposal must become a very live question shortly.

Report on Metal Production

Report on the production of copper, gold, lead, nickel, silver, zinc and other metals in Canada during the calendar year 1918 has been published by the Mines Branch of the Dominion Department of Mines. It has been compiled by Arthur Buisson, B.Sc., mining engineer of the Division of Mineral Resources and Statisticc.

Municipalities and county councils would be well advised in placing their contracts as early as possible this year so that sufficient time may be at the disposal of contractors to enable them to make necessary arrangements as to plant and material to carry out the work before the end of the season. Too often road committees postpone the letting of their highways till well into the summer, with the result that not only do they pay more, but it is often impossible to get a sufficient supply of stone, labor and cars.

Trade Unions and Engineers

Opinion of the Author is That Engineers Can Profitably Adopt Some Features of Trades and Industrial Unions

By Chas. A. Mullen*

IN expressing an opinion on the subject of "Trade Unionism and Engineers," my own thought is that we really need more than a "trade union." Our engineering societies can, and I believe they will, gradually develop into that general form of organization; even though under some more euphonious name, and probably with loud protestations to the contrary. But I also think that wherever an "industrial union" or "industrial council" operates in the industrial unit in which an engineer is employed, he should become a member of such industrial union or council, and learn to associate in a business way with the shop stewards and other "menials" who are our partners in industrial production.

We might, and with profit to ourselves, occasionally sit down at a table and drink a glass of "remembrance beer" with a real "labor leader" of the type common to the A. F. of L. Some think it more appropriate to pronounce the "L" with a cockney accent. Or we might even dine with one of these nefarious "foreign agitators,"—possibly English or Scotch as at Winnipeg,—and absorb more than the bill-of-fare. It would do us no good, professionally and otherwise, to know what these men are thinking; for the superb ignorance of most of us professionals upon a great many subjects outside of that for which we have a special training is truly marvelous. We are sometimes worse than ignorant; we are grossly misinformed through the daily press.

Engineers are But Laborers

The sooner we engineers, and other professionals for that matter, come down from our self-erected mental pedestals and recognize the fact that we are but laborers in the common vineyard, along with the rest of struggling, sweating humanity, the better it will be both for us as a group of professionals and for the community at large. If we are such superior humans as some would have us believe, why, may I ask, is it so seldom recognized on the payroll? The "boss" always seems to be perfectly willing to give us all the "recognition" we could possibly ask—anywhere else. Engineers working for industrial firms have a particularly hard time gaining that form of "recognition" which the butcher and baker will accept, but consulting engineers also have a hard time securing fees commensurate with the services which they render.

There is no definite line of demarkation between mental and manual labor, the work of brain or brawn. It requires a certain amount of manual labor on the part of the best engineers in order that they may apply their mental attainments, and the efficient handling of the busy end of a shovel requires a certain amount of mental labor. The work of some professionals suffers materially because of the lack of that amount of manual labor which is requisite to make it most effective, and vice versa. The first bridge engineer probably both mentally designed and physically constructed his own bridge by cutting down a tree so it would fall across a stream.

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*Consulting engineer and director of paving department, Milton Hersey Company, Montreal.

Two instances will fully illustrate my point. One, a waterworks engineer, a brilliant technician, who re-designed an re-built the waterworks of a city of about one hundred thousand inhabitants at the time I was its Commissioner of Public Works. This man was on the job, both mentally and physically, all the time the work was in progress, and it was done just as he wanted it and at a low cost. What he accomplished certainly could not have been achieved by an armchair engineer who was afraid of the other end of the job.

Another instance is that of two concrete mixers of the continuous type which I was operating in 1907, as a contractor, at two different points on the same street. One was manned entirely by a poor grade of Italian labor, and the men shovelled into the sand and stone hoppers of the mixer without apparent rhyme or reason. The result was hoppers that were sometimes full and sometimes empty, and a very unsatisfactory product in the finished concrete was secured despite all the foreman could possibly do.

The other continuous concrete mixer was manned by a group of Austrian laborers, who soon proved their superiority as such by organizing themselves into a shovelling brigade, each man in his place, and all operating in unison to the notes of a "chanty." They would shovel so many "beats" then rest so many, then again shovel so many; and the shovelling and resting periods were so arranged that the hoppers would get low but never empty. This performance went forward all through the day, with both rhyme and reason which were very apparent in the quality and quantity of concrete mixture produced. Some brains at the busy end of these shovels; for fewer shovels produced more concrete of a superior quality

"Trade" Unions and "Industrial" Unions

It might be stated that the "trade" unions cut through the industries along "craft" or "professional" lines. That is, all the carpenters are in one organization, no matter whether they are building country bungalows, laying factory floors or erecting wooden forms for concrete bridges. This form of union organization has the better opportunity, if it will but use it, to produce, by education, a very high grade of carpenters, men with whom their trade is a profession and who are really craftsmen. By some, it is not thought to be good fighting formation when a strike becomes necessary, either for the men themselves or for the public at large; for the many small strikes which it usually engenders keep industry in a turmoil without anyone except those directly concerned knowing much of what it is all about.

The other form of labor organizations, the "industrial" unions, do not cut through the industries, but co-ordinate with the industry in which they are formed and are intended to include all the employees in that industry. They do not offer the same educational opportunities as do the "trade" or "craft" or "professional" unions, but it seems to me that they do promise to finally bring about a certain harmony in industry which is likely to be of great benefit to the workmen and to the public as well. Under this form of organization, fewer strikes occur, and, when they do, not one "trade" but the entire "industry" goes out, the issue is more clearly joined, and in such a way that everyone is likely to know the cause of the trouble.

There is at present a very decided trend in labor circles away from the "trade" and towards the "industrial" method of dealing with difficulties between employer and employe, even when the men are organized along "craft" lines, and I think this trend is in the right direction for the good of the employer, the employe and the public. There certainly has been much to regret in the past working out of the "craft" form of organization, some of the leaders of which were altogether too "crafty"; and nothing is more aggravating than the inability of an employer to keep peace in his own shop, or of the combined employers of an industry to keep peace in their own industry, because he or his representatives cannot get into direct contact with his own men and their directly selected representatives, without dealing through some professional "labor leader." The "shop steward" is much nearer to the employer, and much more likely to understand his side of the case, than is the old time "professional" labor leader who has particularly cursed the American labor movement.

Labor "Councils"

There are also many labor "councils" organized on both the "trades" and the "industrial" basis, and one may fairly well judge the thought of the organization by the adjectives which it uses. Such councils may cover a nation, a province, a city, an industry, or merely one plant, but their real object is always to bring together the trades in some district, large or small, for some form of concerted "industrial" action. The largest part of the labor movement now seems to be floating around in a sort of no-man's land between the two types of organized endeavor; and recently, purely "craft" unions, such as those of the building trades, have, through their central "councils," organized and called "industrial" strikes, or entered into "industrial" agreements which promise to provide a fairly stable and productive peace.

Engineers certainly need careful organization along both "trade" and "industrial" lines. In the labor world, most workmen are in favor of one type of union or the other; I am in favor of both. It seems to me the "trade"union should be principally a mutual benefit and educational or "professional" centre, while the "industrial" union should be, for the present at least, primarily the "arm" for use when "arguing" with the "boss," if anyone wants to put it that way; that is, the "economic" union, which is the only medium with which the workers can meet the employers' "economic" unions for the purpose of "collective bargaining" which we are told is to solve the Labor-Capital problem. The co-organization of the two is no more impossible or impracticable than the cross-indexing of a library; and, given the desire to do it, probably presents no more real difficulties.

Join Both Unions

I think every engineer should be a member of his proper engineering society, and that all the engineering societies should be closely federated into a sort of central engineering council, as has already been done to some extent. They should have the same, and no more, legal recognition and protection that labor unions may have; for what we ask for ourselves we should willingly grant to others. And every engineer should, I think, also become a respected member of whatever labor organization prevails in his industry. For instance, the members of the city engineering department should be members of whatever union formation exists among the city employees, whether it is in a straight industrial form or a "craft" form with a central municipal industrial labor "council" upon which the "crafts" are all represented. Possibly there would be less trouble with municipal strikes if such were the case, for out of mutual understanding frequently grows agreement.

If some of us who consider ourselves "free, independent, professional engineers" would not dare join a real "trade union" or a real "industrial union," for fear of being ignominiously "fired" by the "boss," just as the office boy might be, at least we could study such organizations, form independent and scientific opinions, and acquire a sympathetic understanding of them. It is time we stopped pining to be the "Little Brother of the Rich" and aspired to be worthy to become the Big Brother of the Poor.

Engineers as Menials

Besides, where are we to stand when this much talked of "democracy in industry" or "co-operation between Capital and Labor" is brought about, and Capital sits on one side of the Directors' table with Labor on the other, as per the "Whitley" and some of the other even more promising schemes for securing that degree of harmony which is necessary if we are ever to have the "increased production" which the Directors of the American Association of Engineers think so desirable? Are we engineers to be the only "menials" remaining in the industrial family, supplicating for crumbs from the festive board, while the bricklayers, plumbers, miners, trainmen, and so forth, all become principals?

And if the "law of supply and demand," which the Directors of the American Association hold in such reverence that they expect it, unaided, to cure all the engineers' ills, should be tardy in necessitating the services of some of us engineers, are we to sit idly by and see our wives and children want, are we to go out and compete for the jobs of our fellow engineers and thereby run down the level of our "rewards" still further or what? The "law of supply and demand" is one of the fetishes of the times, which our experience during the war should have destroyed, but apparently has not. This obvious, natural law has never been handled scientifically for the benefit of the public, but has been left free to lumber around our industrial structure hurting or helping whom it may, except when the "monopolists" have deliberately prevented it from working, to the public's injury and to their gain.

"Recognition" Not Pay

The engineer is a workman, nothing else, and I have sometimes noticed that those who think they are something different are usually the engineers who "work" the hardest for the least pay. Our natural interest, as engineers, is with those who "work" in industry, not with those who "own" industry. The most of us "own" nothing but our education and skill and native ability as engineers, and we very frequently "owe" someone for the education. Those of us who "own" something apart from our profession, and I may include myself amongst the number, should not confuse our interests as "owners" with our interests as "working" engineers. The sooner we wake up to the fact that as a professional group we are primarily "workmen," and act accordingly, the sooner we will be able to provide our wives and children with those superior luxuries enjoyed to-day by the wives and children of bricklayers, machinists, tailors, plumbers, and other "workers" who do not accept "recognition" as part payment for the services they render.

All Do Some Wrong

To say that some of the things "labor unions" stand for and do wrong, does not seem to me to be a valid argument against engineers having or belonging to "labor unions." What other organization is there that does not at times do things which some of us think are wrong? Certainly do not the governments at Ottawa or Washington, which are unions, or rather councils of unions, of which all of us are supposed to be members, and for the actions of which each of us is at least to some extent responsible. If, as I maintain, we are but "labor," we should take our place with Labor. Certainly no one will contend that, as engineers, we are Capital any more than is our aristocratic friend, the neighborhood plumber, unless it is merely in a matter of degree. Had we not neglected to take our place with Labor, we might have led the way to better understandings of industry than have prevailed and to better lines of industrial action than those which have sometimes been followed and of which we may rightly disapprove.

The human race advances slowly; and, apparently, seldom until its stomach prompts the march. Probably the H. C. of L. will do for us engineers what nothing else ever has; set us moving together in our own interests; which, in the end, I believe will be very greatly for the benefit of everybody. There was never a time in the world's history when the services of good, conscientious engineers were more necessary. If we could but apply to the "politics" governing our engineering projects that trained, straight thinking which we now apply to the "brick and mortar" part of those problems, I think there would soon be a happier and better world for us all to live in. To-day, we are too frequently but the creatures of "politicians" and "profiteers," doing their bidding; or, at any rate, practising our professions very largely by their leave. The order should be reversed. But there is no one going to do this reversing for us; we must do it ourselves.

Francis Hankin & Co. Limited, Coristine Building, Montreal, announce that Mr. Ray R. Knight, M.E.I.C., has just been appointed their Toronto manager and representative engineer, with offices at 609 Temple Building. Mr. Knight came to Canada from England in 1911, and occupied the position of chief designing engineer in the Sewer Department of the City of Toronto until February 1913, when he left to take up duties as city engineer of Fort William, which post he held until December 1916. He then obtained a commission in the Canadian Engineers, and was retained at the Engineering Training Depot, St. John, Quebec, as instructor. He was promoted to the rank of captain. For the past fourteen months he has been engaged as chief engineer for the Canadian Incinerator and Furnace Co. Ltd. of Toronto.

Ontario men! The convention of the Provincial Builders' and Supply Association is your convention of the Provincial Builders' & Supply dates, Feb. 10, 11, 12, and the place. King Edward Hotel, Toronto.

Eighteenth Annual Convention of Canadian National Clay Products Association

Representatives of Clayworking Industries Exchange Experiences and Discuss Matters of Interest—Review of Proceedings and Abstracts of Some of the Papers

CO-OPERATION was the theme of the address of President Wm. Burgess of the Canadian National Clay Products Association which met in Toronto for a 3-day convention on January 20, 21, and 22. In starting the proceedings of this convention, Mr. Burgess urged clay workers to get in touch more than ever with all new methods and devices in view of the great changes which are going on in the industrial conditions of the country. "It will require the full effort of every clay worker to protect his own interests," stated Mr. Burgess. "We, as burnt-clay manufacturers, cannot afford to pass unnoticed these changes in industrial conditions. I think brick manufacturers have been somewhat slow in taking advantage of the benefits of getting together and working co-operatively. However, I am glad to report that I can see some improvement in this respect. As never before, the present is a time of co-operation and by meeting oftener, we are enabled to discuss problems of every nature and decide how best to overcome our troubles and difficulties. My personal experience in attending conventions has proven such a course to be profitable to myself and the company I represent. Mingling with brother brickmakers and hearing papers and discussions by other clay workers with experience in various lines, gives us many new and profitable ideas."

It was with this spirit of co-operation in great evidence that the 18th annual meeting of the Clay Products Association convened. Registration of members was large and an early indication was given that they were assembled to get the most out of each other's experience and in turn to give as much as possible for the benefit of clay workers as a whole. It was unfortunate that vaccination orders in Quebec and the United States detained a number of expected delegates.

The president in his address made some comments on progress that had been made by the association in the past year. "The executive" he mentioned, "has been called upon to deal with many questions; the coal situation was again serious and had to be watched carefully so that the interests of the clay working industry would be protected. Railway tariffs are preventing the shipments of certain clay products to border cities and to deal with this a committee has been appointed.

"The removal of Mr. W. W Pearse, the city architect of Toronto, has interfered with questions which were being discussed with him in regard to the improvement in building by-laws affecting clay products. As soon as a successor is appointed these questions will be again taken up. The workmen's compensation is before the executive committee and it is hoped that an improvement in the methods of making refunds at least will be corrected when our reports are laid before the commission. The Technical Education committee has been very active and while we must withhold the plans, you may be assured that the committee will give an excellent account of its stewardship at no distant date.

"Mr. Keele continues to give great assistance in the carrying out of tests, the results of which will be of great value to the industry. During the year we undertook to test clay from Labrador, from which Dr. Grenfell hoped to make brick for his mission hospital. These tests were carried on under Mr. Keele and will probably be continued during the coming year."

The delegates to the convention were welcomed by C. A. Millar, as chairman of the Entertainment Committee. Brief responses to the address of welcome were made by Alderman W. H. Freeborn, of Brantford, and D. C. Merkley, of Ottawa. The Executive Committee made its report through Mr. Keith, the secretary, and the minutes of the last annual convention were adopted as printed in the proceedings. The secretary-treasurer reported a larger cash balance on hand than last year.

Committee Reports

The Tariff Committee reported that efforts had been made to secure some amendment in freight rates as applied to clay products. Clay products are essentially short-haul materials and recent increases in freight rates had operated to the detriment of such classes of freight. As many clay workers are members of the Canadian Manufacturers' Association, the committee had arranged to take advantage of the tariff and traffic department of that organization so as to secure expert information on traffic matters which would have been difficult otherwise. Just for the present the matter is in abeyance until a projected increase in freight rates has taken effect. If this still acts prejudicial to clay products, the committee will become active again.

The Technical Education Committee, through Mr. Millard F. Gibson, chairman, reported progress on an important scheme for the education in Canada of those desirous of taking up the study of ceramics. Heretofore there have been no opportunities for technical training in Canada or for investigational work on the development of our great natural clay resources. No particulars of the committee's report are available as yet, but the meeting was given to understand that some very outstanding developments are pending. It is expected that in February a comprehensive report will be made public.

Officers Reappointed

The election of officers resulted in the reappointment of last year's executive by a unanimous vote. The members of the executive are: Thomas Kennedy, Swansea, past president; William Burgess, Todmorden, president; Ryland H. New, Hamilton, 1st vice-president; Millard F. Gibson, Toronto, 2nd vice-president; T. H. Graham, Inglewood, 3rd vice-president; Gordon Keith, Toronto, secretary-treasurer; and the following councillors, H. B. Hallatt, Tilbury; W. H. Freeborn, Brantford; N. T. Gagnon, Montreal; Andrew Dods, Mimico; John S. McCannell, Milton; F. B. McFarran, Toronto; Chas. A. Millar, Toronto; C. B. Lewis, Toronto.

The papers read at the session of Tuesday, January 20, were "Burning Common Brick in Producer-Gas-Fired Kilns," by George Cutbush, Don Valley Brick Works, Todmorden, Ont.; "Pyrometers for Clay Products Factories," by Wm. Printz, Detroit, with the Brown Instrument Co. of Philadelphia; "Manufacture of Floor Tile, Roofing Tile, Sanitary Cove, etc," by William Robertson of the Ontario Provincial Clay Products Plant, Mimico; "Stones in Brick Clay," by Joseph Keele, B.Sc., Chief Engineer, Ceramic Division, Mines Branch, Ottawa; the discussion was lead by Wm. Burgess; "Pottery Possibilities in Canada," by Millard F. Gibson, Manager National Fireproofing Co., Toronto.

Pottery Possibilities

In the latter address Mr. Gibson discussed the possibilities of developing manufactures of fine porcelain, glass-ware and clay products generally to take the place of the present considerable quantity imported from Europe and the States. Mr. Gibson told of the many interesting examples of fine pottery, glassware, etc., which have been made under the direction of Professor Keele, at Ottawa. He instanced the discovery of a new bed of white clay near James Bay which with the large deposits of feldspar and other minerals will make it possible for Ontario to go in for the manufacture of fine chinas, ornamental glassware, optical glass, etc., and he felt that every encouragement should be given to the development of the ceramic industry on the widest scale possible.

Tile for Farm Purposes

On Wednesday, January 21, Mr. T. L. Ferguson, of the Ontario Agricultural College, Guelph, read a paper on "Clay Tile for Farm Drainage Purposes," and Mr. Wm. Burgess described "Modern Methods in Soft Mud Brick Manufacture." Messrs. W. H. Freeborn, of Brantford, and C. H. Burk, of New London, Ohio, participated in the discussion on this topic. An interesting discussion on kilns was started by D. C. Merkley, of Ottawa, who described the Minter System as installed by him.

"Power Transmission and Material Conveying" was the topic of the first paper on Thursday, January 22. It was read by Mr. S. R. Walsh, of the Goodyear Tire & Rubber Co., New Toronto. This was followed by a description of the Dressler Continuous Muffle Kiln by Mr. Conrad Dressler, of the American Dressler Tunnel Kilns, New York. Considerable discussion on this topic ensued.

Mr. J. P. Anglin, president of the Association of Canadian Building and Construction Industries, addressed the delegates on the object of the Association of Canadian Building and Construction Industries and the plans for the coming convention in Ottawa. As members of the building and construction industries he urged them to attend the conference and help to unify the industry. Professor Currelly, of the Royal Ontario Museum, gave some interesting facts about pottery and made suggestions about the development of the pottery industry in Canada.

Delegates were given an opportunity of seeing some of the clay working establishments in the vicinity of Toronto. The Ontario Provincial Brick and Tile plant and that of the Dominion Sewer Pipe and Clay Industries, Limited, were among the places that were inspected.

The social features of the convention included a theatre party and the annual banquet on Wednesday evening, at which over 100 were present. Guests at the dinner included Brig. General C. H. Mitchell, C.M.G., J. C. Reilly, Secretary of the Association of Canadian Building and Construction Industries, and Hon. H. C. Nixon, Provincial Secretary of Ontario. Brief addresses were also made by Mayor Church, Alderman Freeborn, of Brantford, Millard F. Gibson, Thos. A. Millar and William Printz.

Mr. Millard F. Gibson, the first speaker, in proposing the toast to "Affiliated Industries," felt it would be a great source of gratification to the clay products industries if they could assist in some small way in the great work before the allied industries. Mr. J. C. Reilly, who replied, recalled the fact that the clay products industry was one of the most ancient and had a great effect upon the history of the world, instancing the use of bricks, upon which the ancient Babylonians had kept their records, and the influence which the attempt of the ancient Egyptians to force the Hebrew people to make bricks without straw had had upon subsequent history of the world. Speaking of the Association of Building and Construction Industries, which he represented, he dealt with the great need there was for building construction in Canada in the future, and, to assure this, felt the great need was cooperation among those interested in the clay products and allied industries.

In proposing the toast to the Dominion, Hon. H. C. Nixon spoke of the Ontario Provincial Brick and Tile plant, which he stated he had found to his supprise was under his direction when he had taken over the Provincial Secretaryship. For many years, he declared, he had been interested in the great industry of clay products in the province, having been on survey work for the Government for some years, when the importance of the tile industry in relation to agriculture was brought home to him. He stated that the Government was making it easy for the farmer to secure money for drainage purposes knowing it would be amply repaid.

Stop Buying in Foreign Countries

In making a survey of Canada and its resources, one realized what a great country it is, declared General Mitchell in replying and he called the attention of his audience to the fact that the nation has just finished the great war, where the sons of Canada (who, incidentally, had had great experience with clay in a variety of ways) had come back filled with ideas and with memories of the things they had seen and heard overseas. One of the greatest assets from the war he thought, would be in the knowledge of intensive farming which the farmers among our armies had gained from watching the French and Belgians. Our men had also seen splendid buildings and would realize what could be done in Canada by using the brains and abilities of her people. The capital of Canada was made up equally of men and material, both of which should be used to develop this splendid country.

With reference to the allied industries which had been mentioned, General Mitchell said he hoped that soon there would be developed pottery and fine arts, as well as the industries in glass and refractory materials for furnaces. He hoped the present export of gypsum, half of which left the country, would be stopped, and recalled the assertion of Sir Edmund

Walker that Canada is buying too much from the United States, telling the members present that it was up to them to build up the clay and allied trades, and instead of buying in the foreign markets, to sell to them.

A welcome from the city was extended to the members present from Mayor Church, who assured the convention of the importance of their products in the vital matter of housing the populations of the great cities.

Burning Common Bricks in Producer-Gas Fired Continuous Kilns

Advantages Include Ease of Operation, Economy of Fuel and Uniformity of Results

By Geo. Cutbush*

THE producer-gas-fired continuous kiln has come to stay. It has so many advantages over the coal-fired continuous kiln that brick manufacturers should think twice before making an installation of coal-fired kilns. Some of the advantages of the producer-gas-fired kiln are:

1. It is easy to operate.
2. It gives uniform results.
3. It is at all times under the control of the burner.
4. There is less waste than with any other continuous kiln.
5. The goods are free from ash and dirt so common in other systems.
6. It is economical in the amount of fuel used.
7. The conditions under which the setting and unloading of the goods are performed are ideal.

Before getting the producer to work, it is necessary to start fires in the kiln, for which provision can be made by putting in furnaces which discharge into one of the main flues. Conductors are placed three or four chambers ahead of the firing chamber, thus linking the kiln to the main draft flue which is controlled by a suction fan. It will require about forty-eight hours to water-smoke, and raise the temperature in the first chamber sufficiently to burn the gas. With some clays it may take seventy-two hours or even longer. When the temperature of the kiln reaches 700 deg. F. the producers may be started. I have found it a good practice to connect the producers to the kiln as soon as possible after starting them, as the heat from the producers will dry up any moisture there may be in the gas flues, and will warm the flues, thus preventing a possible explosion when the first combustible gas passes through them. It is possible to have gas burning in the kiln within one hour of starting the producers.

Rate of Temperature Rise

The quantity of gas used can be regulated by dampers or valves placed at the kiln for that purpose, thus securing a gradual rise in temperature. It is not possible to lay down any hard and fast rules as to what the rise in temperature per hour should be. That can be decided only by experimenting with the clay to be burned. Twenty-five deg. F. is sufficient for some, while other clays may be given a rise of 50 deg. F. per hour with safety. It is not a good practice to raise the temperature at the top of the kiln much faster than it can be drawn into the bottom, for if the clay contains a high percentage of fixed carbon and the temperature is increased too fast the surface of the brick will become vitrified and this will imprison the carbon, which in time will form a gas, that, in its effort to escape, finding its passage through the pores of the brick blocked, will swell or bloat the bricks, producing what is commonly known as "black core." This condition may occur in any kiln and can be prevented by admitting abundance of air during the oxidizing period.

It will be seen that the gas kiln is at all times under the control of the operator. With fan draft and gas valves close at hand, there is no difficulty in regulating the supply of oxygen or gas.

Practically no Waste

There is less waste with the gas kiln than with any other continuous kiln. Since looking for data for this paper, I have taken particular notice of kiln waste. In the first four chambers we examined, containing about 300,000 bricks, by actual count we had only three bricks that were not saleable. In the next four chambers, containing about the same number of bricks we could not find any spoiled bricks—a record, I think, which no other continuous kiln can show.

Economy in fuel consumption is another point in favor of the producer-gas-fired kiln. This is mainly accomplished by using the heat that radiates from the chamber under fire to preheat the chambers ahead. The chamber immediately preceding the firing chamber will usually record 1200 deg. to 1300 deg. F. It will readily be seen that two-thirds of the burning has been done by radiated heat, and with many clays it only requires twenty-four hours to finish the burning after the gas has been turned into the chamber.

The kiln at the Don Valley plant has twenty chambers, each holding about 75,000 bricks of about six pounds weight each. We regularly burn the twenty chambers in thirty days. This time includes all stops, such as burning soot out of flues, making repairs on engine or fan, etc. This gives us an average for every working day of nearly 70,000 bricks or 50,000 for every day in the week.

Low Fuel Consumption

The amount of fuel used per thousand is low in comparison with some kilns. Here again I have taken a number of rounds of the kiln in order to get a fair average. Our average for five rounds of the kiln, or 7½ millions of bricks, has been, for this season, 400 lbs. of coal per thousand, the lowest consumption being 385 lbs, and the highest 410 lbs. This includes the coal necessary to produce steam for the gas producers, and power for running the fan, for which we must allow 50 lbs. per thousand thus leaving 350 lbs. per thousand for the actual process of burning, which, it will be admitted, is a low average, especially when the almost entire absence of waste is taken into account.

There is still another advantage to the credit of the gas-fired kiln. The goods come from the kiln absolutely clean; no ash or dirt from the firing ever reaches the kiln, thus making the conditions for setting and emptying ideal.

Perhaps a word about the producers will not be out of place. Although formidable looking apparatus, they are not difficult to handle. The producer in general use on the gas kiln is a hand stocked, water-sealed producer. Air is forced into it by means of a steam jet-blower and the amount of air admitted will depend upon the condition of the producer, the class of fuel used, and the amount of gas needed at the kiln. This is easy to regulate, and there is no difficulty likely to arise at the producer which cannot speedily be overcome.

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*Of Don Valley Brick Works, Todmorden, Ont.

Pyrometers in Clay Products Plants Improve Operating Conditions

Accurate Knowledge of Thermal Conditions Produces Consistently Better Ware

By Wm. Printz*

WITH an accurate knowledge of temperatures at all times in the manufacture of ceramic products, such as pyrometer equipment provides, it is possible to obtain an improved quality of ware, increase the efficiency in the operation of the kilns, which naturally means economy in fuel consumption and it is possible, with these instruments to duplicate previous good results; in other words if all other conditions are the same, by duplicating, as nearly as possible, the previous temperatures, you can readily duplicate the good results of the past.

Regarding the quality of brick, and this especially concerns face brick plants, the temperatures are very important, in turning out a product of a certain shade or uniform color. At sewer pipe plants the proper regulation of temperatures eliminates blistering or checking of the pipes.

You can readily appreciate that with an accurate knowledge of the thermal conditions in the kiln, it is possible to force the kiln and still keep within the safety zone. In this way, you would save fuel.

Indication of Temperature

The principle upon which pyrometry is based is as follows: The thermo-couple, which is made up of two dissimilar metals welded together at the end—metals such as pure platinum and platinum rhodium alloy—has the welded end inserted permanently in the kiln. The difference in temperature between this welded end and the opposite end, known as the cold-junction of the thermo-couple, is responsible for the generation of electrical energy. You can really liken a thermo-couple to a dynamo in the fact that it actually generates electricity, although it is based on entirely different principles. Then this electrical pressure, or millivoltage is measured directly by means of a galvonometer or meter which may be located any distance away from the thermo-couple. It is possible to use a number of thermo-couples in one instrument when using a switch, for instance, if you have a large number of chambers, it is possible to permanently locate a thermo-couple in each and have them all wired up to a switch-board, mounted below the indicator, getting the temperature immediately of each individual kiln. The convenience of this arrangement no doubt is fully appreciated since it will tell the firemen in a moment exactly what kiln they should give their immediate attention to.

A Check on The Burner

One of the most popular installations for the ceramic industry is to have the indicating pyrometer and switchboard all mounted amongst the kilns, providing the burner or operator with a sheet ruled off with kiln numbers along the top and time intervals along the side. This is filled in with the actual readings from the pyrometer at the stated intervals. In the office of the superintendent, any distance away will be located one of the several recorders with a suitable plug type switchboard for selecting any of the various kilns that happen to be in operation, obtaining thereby, a continuous record. These records are compared the next day with the temperature sheet handed in by the burner and the readings that were wriitten down by the man should correspond with the readings automatically printed by the recorder at any particular time. You can readily appreciate that with this arrangement you are sure that the men actually read their pyrometers and follow instructions. It is impossible for one to hand in fake readings with an arrangement such as this.

A recorder is generally very necessary, especially where unreliable help is involved. The tendency of the firemen in a number of plants is to make his job just as easy as possible and he will take advantage of the absence of the boss, by indulging in sleep. You can readily appreciate how disastrous it must be to the quality of your product to have the kiln drop in temperature in the midst of the burn, then suddenly have it subjected to excessive heat which would be the result of sudden firing toward the early part of the morning. This inconsistent kiln operation would also reflect on the fuel bill.

Location of Pyrometer

The most popular place to insert the thermo-couple in the round kiln of the down draft type, is one-quarter way up the arch and between the two bag walls. The couple should be in its tube about three or four inches from the inside of the crown. Of late, we have found some practical brick makers who desired to also obtain the temperature near the bottom of the kiln and have inserted their thermo-couples through the wall about three feet from the floor.

On the continuous kilns, the proper place to insert the thermo-couple is also in the crown of each chamber and with the same degree of insertion. On the old type of Dutch oven kiln it is not practical to use any kind of a pyrometer since there is no way to apply one.

Regarding the financial cost in the actual installation of pyrometers and the cost of their maintenance, I would state that if the total cost is divided among the total number of kilns, the initial cost per kiln is not very high and it would surprise one who is not familiar with the matter to find that the actual upkeep cost per kiln is so small in most plants as to be almost negligible.

The benefits derived by such an investment in pyrometer equipment are so great that we find all of the larger plants completely equipping with pyrometers, with the smaller manufacturers rapidly following.

The question of draft also enters into kiln operation as well as proper thermal conditions. Without having complete regulation over the amount of draft and a knowledge of changing draft conditions you cannot operate your plant in the most efficient manner. Where there is a strong draft the kiln will burn faster and naturally the dampers in the stack should be accordingly adjusted. By a very small investment in draft guages, this information may be readily obtained.

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*Of Brown Instrument Co., of Philadelphia, Pa.

Clay Tile for Farm Drainage Means Better Results and Bigger Returns

In Dry Seasons or Wet, Tile Drains Prove Beneficial—Tests for Quality of Pipe

By F. L. Ferguson, B.S.A.*

DURING the last five years we have obtained some very interesting, as well as educating, figures on the benefits received from tile draining. From September 1913 to August 1914, the precipitation was the smallest for any similar period, yet in spite of this the drained portion of our demonstration plots gave an average return of $14.12 per acre more than the undrained portion This is very striking proof of the claim that drainage is quite beneficial during a dry season.

The year 1915 was perhaps the most favorable for undrained land of any we have had in the last five years. The spring was fairly dry, moderate rains followed during the growing season, and sufficient during the ripening period for proper filling. Yet in spite of this the average returns from fourteen demonstration plots, show a difference of $4.48 in favor of the drained land. Allowing for a cost of $40 per acre for tiling, this would be a return of a little over 11% on the money invested.

It is not necessary to mention the returns in the wet years of 1916 and 1917. Tile in many cases meant the difference between no crop and a good crop. The tile, and expense of tiling were paid for many times but the fellow without tile suffered severely.

The farmer has learned or is learning his lesson either by experience of other people or through sad experiences of his own, and the result is that we have today a demand for tile that cannot be met or at least is not being met, and in this business as with any other, the demand has not helped to improve the quality of the product.

The tiling industry might be spoken of as being in its infancy. It has been estimated that one-third of the cleared land of Ontario, or about 5,000,000 acres is in urgent need of drainage, while much more would be greatly benefited. Then there are large areas of swamps and marsh, which might be reclaimed—probably about a quarter of a million acres. These figures refer to old Ontario. Much of the clay belt of New Ontario will require drainage before it will produce to its full capacity In Quebec and the Maritime Provinces, where there is considerable more rainfall than in Ontario much drainage is needed. Consequently, there is bound to be a growing demand for the manufacture of land tile.

Quality to be Determined

One of the questions with which we are confronted is the quality of the tile that is being made. We hope to do some testing in an endeavor to find out something of the quality of the tile turned out. So far as I can find out there has been nothing done in this country along this line, and our methods and equipment may be somewhat crude, but with experience these will improve.

Using the U. S. standard of specifications as a basis I would like to give briefly an outline of the work I would like to see undertaken. The tests would be three in number: Strength, absorption and freezing and thawing, and these tests would apply to concrete as well as clay. It is possible that they are more necessary in the former than in the latter.

(a) Strength Tests of Drain Tile

1. Specimens to be broken and full size. 2. Walls as thoroughly wet as will result from being completely covered with some absorbent material, which has been kept dampened for not less than 12 hours 3. Specimens must be kept at a temperature not lower than 40 deg. F. until tested. 4. Each specimen shall be weighed just prior to testing and weights reported. 5. Sand bearings, hydraulic bearings or three point bearings may be used. 6. The results shall be expressed in pounds and per linear foot, for five individual specimens, together with the average.

(b) Absorption Tests for Drain Tile

Specimens.

1. Three specimens shall be taken from each of the five tiles broken, one from each end and one from the middle.

Each specimen shall be from 12-20 sq. in. in area measured on the convex side, and shall be as nearly square as the material will permit Each specimen shall be sound, solid, free from cracks, fissures of shattered edges, and shall be marked as to permit identity at any stage of the test.

Drying Specimens.

2. All specimens shall be weighed to the nearest gram.

They shall then be dried in an oven at not less than 110 deg. C. (230 deg. F.), for not less than three hours.

When removed they shall be cooled to 20-25 deg. C. (68-77 deg. F.) and reweighed.

If the weight does not check closely on the first, they shall be placed in the drier for two hours and reweighed. This must be repeated until the weights check .

3. Specimens shall be placed in a suitable woven-wire receptacle, packed tightly enough to prevent jostling, covered with distilled or rainwater raised to the boiling point and boiled for five hours, and cooled in water to a temperature of 10-15 deg. C. (50-59 deg. F.).

4. The results shall be calculated as percentages of the initial dry weight,—to the first decimal place. Each individual specimen shall be reported separately, together with the mean of the fifteen or more specimens comprising the sample, the maximum and the minimum single observations entering into the mean, and the variation between the maximum and the minimum of the three specimens of each tile represented in the standard sample.

(c) Freezing and Thawing Tests of Drain Tile

1. The test specimens used in the absorption test shall be used for the freezing and thawing tests, or other specimens shall be prepared in the same way, taking the same precautions re selection, drying, immersing, boiling and cooling.

2 Specimens shall be kept immersed until this test is commenced. They shall be placed in metal trays with concave side upwards, and immersed in ice water until the specimens have attained substantially the temperature of the water, after which the water shall be drawn down to a depth of ½ in. in each tray. The trays are then placed in a freezing apparatus.

Freezing must be performed in a quiet atmosphere free from natural or artificial currents. The temperature shall be reduced to 10 deg. C. (14 deg. F.) or below within thirty minutes after the introduction of the specimens. The temperature shall not fall lower than 20 deg. C (4 deg. F.) The freezing shall be continued until the water in the trays is frozen solid.

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*Of Ontario Agricultural College, Guelph, Ont.

At the conclusion of the freezing, the specimens shall be withdrawn, and at once immersed in water at a temperature of 85-100 deg. C. (185-212 deg. F.) Heating shall be continued so that the water will regain the required temperature as soon as practicable, after the specimens are immersed. This shall be maintained for not less than 15 minutes.

The specimens shall then be cooled rapidly in water at 10 to 15 deg. C. (50-59 deg. F.), and then inspected.

3. Failure under the freezing and thawing treatment shall be considered to be reached when:

(a) The specimens show superficial disintegration or spalling, with loss of weight of more than 5% of the initial dry weight, or,

(b) The specimens are badly cracked in other than lamination planes, or,

(c) The specimens show evident serious loss of structural strength.

Ontario Govt. Clay Plant Makes Fineware and Special Products

Processes Employed in the Manufacture of Floor and Roofing Tiles

By William Robertson*

THE Provincial Government Clay Plant at Mimico, Ont., was originated so as to give employment to prisoners and to teach them a vocation that they might follow after they had served their term, as well as to experiment and develop the clay products industry. The plant was conceived and constructed by Mr. S. A. Armstrong, the late assistant provincial secretary. It was designed to have a capacity of 30,000 common brick, the total production of this plant to be supplied to the different government departments for new government buildings.

After a few weeks running on common brick it was decided that the plant should manufacture all ceramic products required for government use. As a result the best equipment obtainable was installed, and lengthy experiments were carried out at the University. At the present time the following products are manufactured at the plant: common brick, tapestry brick, structural tile of all sizes, agricultural tile, conduit tile, special shapes of brick, floor tile with all the special shapes, Spanish roofing tile with all special shapes, shingle tile, etc. It might be mentioned that all these products have since been shipped to every province in the Dominion.

Shale for Fineware

It is my intention to deal broadly only with the manufacture of the fineware, as this part of the industry is more or less new to Canada. At Mimico we have a deposit of about four feet of clay overlying the Hudson River Shale. The shale is comparatively free from limestone, but there are a number of wide seams of the free stone which are picked out by hand. For the fineware it has been found that the shale gives a richer and clearer color.

The shale is hand picked from the pit and is passed up through the dry pans and from here it is passed to a pulverizer where it is finely ground to pass a 100 mesh screen. It is absolutely important when shale is used for fineware, that it be broken into the finest particles possible, otherwise it will be found that in passing the die the product will have a striated surface and further, that in burning, if the small particles of carbonate are not broken up, they will cause an eruption on the surface of the tile.

The pulverized shale is elevated and conveyed to a Berg which ventralizes the finely divided portions of salts, and so eliminates the scumming of the product upon burning one per cent. Barium cork. The shale is thoroughly pugged into a uniform elastic mass, and is dropped into an auger machine where it is forced through the dies onto a roller and conveyed in a smooth ribbon where it is wire cut into the required length. From here it is picked off by hand and placed on forms on cars to be passed through dryers.

Drying Process

The product from the die is transferred by cars to the continuous tunnel dryers. At the rear end the temperature is maintained at about 120 deg. F. and at the exit end at about 275 deg. F., the length of the tunnel being about 90 feet.

It has been found that the most important points in the drying of fineware, are that the products must be passed through the tunnel at a uniformly accelerated increase in temperature, and that the humidity of the atmosphere must not be drawn through the flues too rapidly, vice versa, it will be found that if the humidity becomes too great, the wares will become softened and will sag under the weight carried.

The cars upon being drawn from the dryers should not be pulled directly in normal atmospheric conditions, but should be run into specially designed cooling rooms where they may be brought gradually to normal atmospheric conditions, otherwise it will be found that the fine surface of the ware will be marred by innumerable small checks. Our dryer losses at the present time amount to about 2 per cent. which we consider very low for fineware. We have only been able to reduce losses to this very low percentage after a great deal of study. The exact regulation of damper in the drying process of fineware, is important that scumming may be avoided. Scumming is the greatest enemy to the manufacturer of fineware.

Saving in Fuel

After passing the proper drying process the ware is transferred to the kiln for burning. At this stage the most salient feature of this plant is that all our fineware is set and boxed in, not by the usual burned fireclay slabs, used by most foreign fineware plants, but by the product of our own plant namely common brick, and hollow tile, which are manufactured in conjunction with the fineware. The fineware is completely boxed in by other products of the plant, the burning of which may be considered as nil as compared to the B. T U.'s used in raising the temperature of the usual fireclay slabs to the burning temperature of the fineware. In other words, instead of wasting many thousand B. T. U's in raising the temperature of a cold fire clay slab to the burning temperature of fineware, these B. T. U's are used in burning our own product, namely brick or or hollow ware, thus effecting a great saving in coal consumption. I would point out the importance of a gradual accelerated increase in temperature in the process of burning, as a rapid increase will invariably cause checking and cracking on the surface of fineware. Likewise, after a kiln of fineware is burned it must be gradually cooled off as a rapid change will invariably cause cracking and checking.

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*Of Ontario Provincial Clay Products Plant, Mimico, Ont.

Methods of Handling Brick Clays Containing Stones

Pebbles in Clay are a Source of Trouble—Crushing, Dry Pan and Washing Processes

By Joseph Keele, B.Sc.*

If a clay contains only a few scattered pebbles of rock other than limestone or dolomite, then it may be worked, if its other properties are good. Broken wires may frequently occur in the cutter if stiff mud brick is being made, or an occasional brick will fire-check if it contains too large a pebble, but if proper crushing rolls are provided for the clay to pass through or if a dry pan is used for grinding, the loss of time due to broken wires can be stopped. It is the presence of limestone pebbles that causes the real difficulty in working stony clays.

Many methods have been tried for eliminating the troubles due to limestone in clay, the simplest probably being that of using a pair of rolls set above the machine. Rolls that are designed for crushing stony plastic clays, reject the rocks or hard portions which are too large to fall within the angle of nip and grind or pulverize the smaller stones which pass through with the clay. The Diesener Clay cleaner is a machine devised especially for removing pebbles and coarse grit from plastic clays. In this process a bar of clay is pushed from an augur machine through a slot and against a revolving disk. The disk sucks the clay through the slot but the pebbles stop behind and are scraped away with a knife. This machine is said to purify clay at the rate of 10 tons an hour through a slot of one-sixteenth inch.

Another scheme is to use a dry pan with the mullers set an inch or so above the surface of the pan. This process is supposed to break down the clay and force it through the perforated bottom of the pan while the pebbles stay behind. The pan is stopped occasionally while the stones are thrown out.

Another plan is to grind the clay, pebbles and all, in the ordinary way in a dry pan, working continuously, and run the clay over screens so as to reduce the limestone pebbles to small enough size to be harmless. In using the dry pan method the clay must be in the dry condition; this involves the provision of a storage room for drying clays or the use of rotary dryer.

It has been proved that unless limestone in clay is ground finely enough to pass through a 30 mesh screen it will cause trouble by developing soft white specks in the burned bricks which will cause flaking of the surfaces. Of course these small grains of lime, unless very plentiful, would not weaken a well burned brick very materially, yet they would be sure to disfigure brick for facing purposes.

As it is not practical in any of the crushing or grinding processes to reduce the pebbles to this small size, the trouble with lime grains is not entirely eliminated by them. Furthermore, any of the rough grinding processes, such as passing the clay through rolls, merely accentuate the trouble, since they often break up one pebble of limestone into several smaller ones, each of which then becomes active after burning.

The most effective way to treat clays containing limestone pebbles is by a washing process which would leave the stone behind as a heavy residue, the overflow taking the fine clay down to settling basins. Washing of high grade clays, such as kaolin and stoneware clays is the common practice, but the poorer grade of clays used for brick and tile are not washed because the value of the product will not offset the extra expense. One plant at least, however, in the United States, successfully cleanses glacial clay from limestone pebbles by a washing process.

Some of the glacial clays in southern Ontario would yield good tile clays if washed, and a small or medium sized plant situated in a district where there are no tile plants at present and no stoneless clays available, should have a chance of succeeding. Such a plant, however, could not ship its products over any considerable territory as it would the meet the competition of plants using clay that is free from limestone pebbles and therefore more cheaply worked.

Hitherto we have been dealing with the treatment of the raw clay but there are certain aspects of the burning and of methods dealing with the burned product which must be considered. In certain parts of England where clays containing limestone pebbles are worked it is customary to grind clay as fine as practicable and after the bricks are burned the cars on which they are loaded are drawn through a pool of water so that they are completely immersed and saturated. This treatment slakes the lime particles quickly and appears to do less damage than if they were allowed to slake and expand slowly from the moisture absorbed from the atmosphere.

At the Don Valley Brick Works in Toronto, there are certain beds of stony clay interbedded with the stoneless clay and both are worked together. As the clay drops down through the rolls from the pug mill the larger stones are expelled by the rolls and the small ones go through to the machines and are crushed. This clay is used in the manufacture of end wire cut brick and burned in an overhead fired continuous kiln. The limestone particles give surprisingly little trouble in the burned product. It seems as if the method of burning had something to do in checking the subsequent activity of the lime particles due to the smoky atmosphere and reducing conditions present in the chambers of the continuous kiln. The reducing condition at high temperatures appears to cause fusion between the surface of the lime particles and the surrounding clay and this fused skin prevents the access of moisture to the lime, but whatever the reason is the lime is more effectually killed than it would be after coming through a well oxidized firing.

Finally we have to consider the addition of some substance to the clay which would prevent the slaking of the lime after burning. The writer has made many experiments to this end but found that the only practical thing to do was to add some salt to the water used in tempering. A set of test pieces of burned clay containing limestone particles to which one per cent. of salt was added have now been standing in the laboratory for about a year and show little or no indication of disintegrating, while similar test pieces made up without the salt have gone to pieces long ago.

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*Chief Engineer, Ceramic Division, Mines Branch, Ottawa.

Toronto Builders' Exchange Annual Meeting

Reports Show Good Work Accomplished in a Year of Unusual Difficulties—Membership to be Augmented

THE annual meeting of the Toronto Builders' Exchange was held on the afternoon of Tuesday, Jan. 20, when a large number of the members gathered together to elect officers and discuss the business of the exchange. After the minutes of the annual meeting of 1919 had been read and confirmed, the President, Mr. A. D. Grant, presented his report. Mr. Grant pointed out that there had been a large increase of membership and activities since the last annual meeting. During the war the building industry had suffered from a partial paralysis, but for the coming year there was every prospect of good business unless labor troubles interfered.

As regards affiliaton with the Association of Canadian Building and Construction Industries, the directors had decided that no further action should be taken until the association had taken more definite shape.

Good Work of Industrial Council

The Joint Industrial Council of the Toronto Building Trades, which had been formed with the approval of the Canada War Labor Board and which had been doing good work, had made a recommendation during the year, that all agreements between employers and employees should start on Jan. 1. This was likely to prove a beneficial arrangement.

It had been decided to resume the publication of the Exchange bulletin, which had been suspended during the war, in order to keep the members in touch with the tenders and contracts and the doings of the trade. While most things had advanced in price, the exchange fee had remained stationary.

The directors of the Exchange had made a grant for the entertainment of the visitors at the forthcoming convention of the Provincial Builders' & Supply Association to be held in Toronto. Hearty invitations had been sent out for all the men of the building trade to attend.

The membership committee had been very active during the year and there was no reason why a further considerable increase in membership should not be secured during the coming season.

A committee on building by-laws had also been appointed to consider advisable changes or additions to the Toronto building by-laws.

New Section Active

A very active section had been added to the Exchange in the formation of the general contractors' section. Plumbers' and painters' sections had also been authorized during the year.

The secretary, Mr. David J. Davidge, reported that during the year 1919 three general meetings had been held under the chairmanship of the President. The average attendance had been 46, which was an average increase of 18 over the previous year. There were nine meetings of the directors, with an average attendance of 11, an average increase of two over 1918.

The Legislation committee had done very good work during the year, but its efforts had been handicapped by the change in Government. It had been instrumental, however, in having the merit rating clause made non-effective so far as the building trade was concerned.

A resolution had been passed providing that all sections should bring all questions of wage adjustment with their employees to the Exchange. The idea was to obtain standardization as far as possible.

The telephone directory, listing the members of the Builders' Exchange, of which 1,000 copies had been issued, had proven very valuable, and was to be gotten out again this year.

Increase in Membership

There had been 55 applications for membership during the past year. Since New Year's, eight more applications had been received. The total membership now was 181.

The Exchange had lost three members during the year through death—Messrs. Geo. Oakley, Melville Young, and J. C. Scott.

The report of the treasurer, Mr. Jno. Aldridge, showed the Exchange to be in a healthy financial condition and some hundred dollars richer than last year.

Election of Officers

The election of officers resulted as follows: President, C. Blake Jackson; first vice-president, Jack Scott; second vice-president, W. H. Painter; treasurer, Jno. C. Aldridge; directors—P. L. Fraser, Jas. Phinnemore, W. E. Dillon, Jno. V. Gray, J. R. Page.

Following the election, Mr. C. Blake Jackson, the president-elect took the chair. Mr. Jackson thanked the members for the confidence placed in him and assured them of his best efforts.

Some general discussion took place regarding the work of the Exchange. Mr. W. E. Dillon asserted that the Exchange had done as much as any other association of its kind, if not better. He pointed out that they had got out copies of the report of the Royal Commission on Industrial Relations and that Mr. Fred Armstrong had represented the Toronto building men at the Industrial Conference at Ottawa last September.

In order that the Exchange might have the financia standing necessary to keep in close touch with the building situation, Mr. Dillon thought they should have at least another hundred members and he moved that the material contained in the President's report should be compiled and printed so as to help out the members in canvassing to increase the membership.

Mr. Dillon also pointed out that a provincial branch of the Manufacturers Association had been formed and this association was anxious for affiliation with the builders. He considered the move would be a good one.

Builders Interested in Technical School Work

Mr. Geo. Gander suggested that the directors should write the Technical school board and request that the building industry should be represented on the advisory committee.

Alderman Phinnemore declared himself heartily in sympathy with Mr. Gander's suggestion. He thought the builders should certainly have representation on the Technical School Board, and he would like to see the Exchange take a more active part in educational affairs. Owing to the shortage of apprentices, he thought it would be well to encourage the technical school students by offering rewards or prizes.

Mr. Bulley said it was up to the members of the Toronto Exchange to boost along the coming Provincial convention and make it a big success.

Favorable Prospects for Provincial Convention

President Elgie, of the Provincial Builders' & Supply Association, pointed out that the Association had done effective work and that they hoped for the biggest and best convention ever held.

Mr. Aldridge moved that the annual fee be paid to the Joint Industrial Council of the Toronto Building Trades and also that the report of the council be sent to each individual section of the Exchange. These motions carried.

On motion of Mr. Grant, it was decided the President should go to the conference at the Association of Canadian Building & Construction Industries at Ottawa, as the delegate of the Exchange.

Wider Sphere of Activity Open to Engineers

Mr. R. O. Wynne-Roberts, New Chairman of Toronto Branch, E.I.C., Gives Engineering Profession a More Important Role to Play

THE Toronto Branch of the Engineering Institute of Canada met on Thursday evening, January 22, at the Engineers' Club, with Mr. Harkness, last year's chairman, in the chair. The secretary-treasurer's report for the past year was read and adopted, after which the chairman called on the heads of the different business committees who reported the results of their activities during 1919. The chairman at this point intimated the need of a membership committee and expressed the opinion that many new members could be recruited from the ranks of the engineering profession in Toronto if they were only gone after. However, the appointment of new committees for the season being entered upon will be left in the hands of the incoming executive. The councillors of the new executive, Messrs. George T. Clark, T. Taylor, Prof. C. R. Young and J. C. Krumm were then called upon and each, in turn, expressed his appreciation of the confidence placed in him by his appointment to the Executive Committee for 1920. Mr. Harkness then surrendered the chair to the new chairman, Mr. R. O. Wynne-Roberts, who read a very interesting inaugural address which is reviewed herewith.

Towards the close of the meeting a vote of thanks was tendered by the members to the retiring Executive Committee for the excellent work done in the interests of the Toronto Branch of the Institute during their term of office. A resume of Mr. Wynne-Roberts' address follows:

"The Executive Committee has deemed it expedient that the chairman should deliver an inaugural address and I think it is a good custom for him to make a few observations on matters relating to engineering. The Committee also thought it desirable for the Chairman to enunciate a policy which we might endeavor to follow during my term of office. The first part I am prepared to conform to, but to declare a policy is not quite so easy because my views are personal and may not harmonize with those held by the members of the Executive Committee. I will, however, try to present a few points for your consideration.

"If our foresight was as good as our backsight we would, of course, carve our future with mathematical precision, but we are not gifted with a prophetic mind. The past nevertheless is prophetic of the future and our opportunities are piling up, in a land that is young and vigorous.

Engineers Links Between Capital and Labor

"One thing, I think, may be stated, and that is, engineers are useful links between capital and labor. Of course, engineers may be put in the same category as labor, but we more or less occupy judicial positions in connection with the public undertakings placed in our charge. Investors of capital have found, by the creative power of engineers, great fields for investments and labor has found abundant employment. Fortunately, by the organizing genius exercised by engineers, both parties have worked in harmony during the past generation. The good common sense of the investors and workers have necessarily helped materially to this end.

"The investors have means of safe-guarding their interests and the workers are well organized to guard theirs. The engineers, however, have been and are still without adequate cohesion, influence or recompense. If they were united in a bond of co-operation, there would be no power or influence to excel it. It requires but a slight effort of imagination to forecast what would occur in Canada if professional engineers went out on strike. Such a contingency is, of course, so remote and impossible, under the present conditions, that it sounds too grotesque for words. But let our imagination have its sway for a moment and what will it suggest? If the professional engineers (or energeers as Sir W. H. Preece once called them) suspended activities, Canadian business would soon be in confusion, life and limb would be endangered and city amenities would at least be much disturbed. These are mentioned only to indicate the function of engineers in their relation to the community. Whilst we are not in a position to protect our interests like other professions, we are also unable to protect the public.

Difficulties Rectified by Co-operation

"This state of affairs will some day come to an end, and we cordially invite all engineers to come together to rectify our corporate deficiencies. The great national engineering societies of Canada, United States and Britain are not rendered inefficient or powerless by the formation or the existence of others which are organized for particular sections of engineers. The national societies, notwithstanding the birth or growth of others, seem to grow more vigorously independently and even by virtue of the activities of allied societies. Still, in unity there is strength. The submergence of personal views and compromising on corporate aims will be advantageous to the profession as a body. There exists a splendid cordiality between the societies and we are sanguine that such relation will continue for all time

"During the past generation, engineers have accomplished great things for the public, but in the matter of status and emoluments we are practically in the same position as in 1887. This implies our inability to do something for ourselves. Unless we bestir ourselves I fear we shall find the status of our profession suffer. The remuneration of engineers, especially those in the employment of others, is inadequate to enable them to maintain their positions with becoming professional dignity, and the Engineering Institute of Canada in concert with all Engineering Societies should strive to improve matters. The fees for the services of consulting engineers should also be established.

"Our Society fundamentally exists to assist each member and, conversally, the members are called upon to do their utmost to promote the interests of their Society. With your cordial assistance we hope to see the Toronto Branch of the E. I. C. occupy the premier position in Canada. We have men, materials, talents and splendid opportunities to warrant the best anticipations.

Establishment of Canadian Engineering Societies

"The history of Canadian engineering during the past generation is suggestive of what is yet to be accomplished. This year is the thirty-third since the establishment of the Society of the Canadian Engineers. The Royal Canadian Institute was established in 1851, particularly for the promotion of surveying, engineering and architecture and its chief sponsor was Sir Sandford Fleming. An effort was made in 1880 by the late E. W. Plunkett to start an engineering society. He issued a circular letter under the pseudonym of X. Y. but no active results ensued. Some engineers in the same year promoted a Bill in the Ontario House of Parliament for the registration of engineers which proposed to classify those who qualified and registered. For example, those put into class A would be qualified to become chief engineers in any line, those in class B would be chief engineers in a particular line, class C were simply engineers and class D assistants. This Bill did not receive much welcome on the part of the legislators nor by the majority of the engineers themselves. The Canadian Society of Civil Engineers was established in 1887. The late Alan MacDougall of Toronto appears to be one of its organizers and it received the sympathetic support of most of the engineers whose names will always be prominently associated with engineering in Canada. The Society started with a respectable number of 288 and to-day it has nearly 3,500 on its rolls.

Past Thirty-three Years Period of Great Engineering Activity

"The past 33 years represents a period of great activity and expansion in this country. Great many of the engineering enterprises were either started in this period or were greatly enlarged. I cannot, of course, pretend to speak from intimate knowledge and experience of the developments that have taken place, but it has been a source of pleasure to spend some time in collecting the data. I would urge upon members to delve deeper into the subject than I have, for the study would be found not only delightful but profitable. We cannot appreciate what we now possess unless we know what it involved in the past. In Tennyson's words "we are the heirs of the ages in the foremost ranks of time." It is interesting to note that the licensing and the status of engineers have, during the past forty years, been subjects of perennial interest and discussion, not only in the press and in our meetings, but before Royal Commissions and in Parliaments."

Mr. Wynne-Roberts then briefly reviewed the development of the different branches of engineering in Canada up to the present time, dealing with roads, waterworks, sewage disposal, electric power, electric railways, steam railways, bridges, irrigation, mining, the pulp and paper industry, harbor and dock works, canals, shipbuilding, and town planning. The development thus indicated has shown that the young tree of civil engineering has grown marvellously and many powerful branches have appeared and are still appearing, and metaphorically, they stand to-day as one magnificent structure.

Lack of Engineers as Statesmen

Mr. Wynne-Roberts wondered if we could not induce some one to give us pen pictures of the lives of eminent Canadian engineers. In his opinion we could spend many a profitable hour listening to and discussing papers on their lives and their accomplishments. "It would also be most instructive and interesting," he continued, "if some one read a paper on what engineers have done in our parliaments. It is manifest that engineers have played an important role in the development of this country, but I would also like to know something of engineers who have served their country as statesmen. There are about 100 cabinet ministers and about 800 members of legislatures and senates, and the point I want to emphasize is the significant absence of engineers in our parliaments and on municipal councils. Since these authorities spend millions of dollars annually and as so few engineers are legislators or aldermen would it not be to the country's benefit if our societies were given opportunities to consider the policy of engineering schemes involving expenditures of public funds? This would be no reflection on the government or municipal engineers but the object I advance is the desirability of having engineering projects publicly discussed by engineers.

"Furthermore would it not be advantageous to the people if the services of engineers were more frequently invited in connection with the different commissions? Engineering problems are often submitted to lawyers and laymen for investigation and whilst the commissioner may be upright and capable, they have not the training and experience of engineers. This brings me to the question of whether in the light of the experience of 33 years, engineers should take a more prominent part in State politics. Personally, I think we should, for the reason that a good number of the questions which we intimately associate with the welfare of the people are either engineering or closely allied to it. Roads, railways, mining, irrigation, forestry, creameries, cold storage, drainage, buildings, agriculture, canals, power, manufactures, ships, docks, labor are all linked more or less intimately to engineering.

"The foregoing observations lead us back again to the status of engineers. Even if a legal status was granted to us now, I think our position in respect to public recognition will depend largely upon the service we render freely to the community and the publicity we invite. We may continue to attend to our own particular businesses with cloistered assiduity and subconsciously enjoy the satisfaction that we have done our best for our employers. But this will not be adequate to satisfy the general public, that we deserve fuller appreciation, we must bid for it and not wait for it.

"One more point and that is the fraternal relations amongst engineers. Etiquette and ethics are useful as beacons to guide our footsteps, but I firmly believe that a solid brotherhood of professional engineers will do much more. Mutual assistance and respect in all professional matters, would be a splendid slogan for our Society to adopt.

Papers at Coming Meetings

"For your information it may be stated that every Thursday night from Feb'y. 5th. to May 6th. a paper has been promised and we most heartily invite you all to attend and take part." The following is a list of the papers:

Feb'y 5th.—Heat Transfer—Mr. E. Metcalfe-Shaw.
Feb'y 12th.—Siberia—Capt. F. A. Dallyn and Maj. C. S. L. Hertzberg.
Feb'y 19th.—Bituminous Roads—Mr. Bruce Aldrich.
Feb'y 26th.—York Township Sewerage Scheme—Mr. J. M. M. Greig.
Mar. 4th.—Debate on "Should Engineers Unionize" Positive Side by Mr. W. Snaith— Negative Side by Prof. P. Gillespie.
Mar. 11th.—Toronto Harbor Works—Mr. Geo. T. Clark.
Mar.18th.—Automatic Telephones—Mr. T. A. Danks
Mar. 25th.—Concerning Bridges—Mr. Frank Barber.
Apr. 1st.—Town Planning and the Canadian Engineer —Mr. A. V. Hall.
Apr. 8th.—Chemistry and Engineering—Mr. T. Linsay Crossley.
Apr. 15th.—Sarnia Intake—Mr F. W. Thorold. Reinforced Concrete Pipes Mr. H. W. Heywood.
Apr. 22nd.—Application of the Venturi Principles—Mr. E. Dean Wilks.
Apr. 29th.—Dredging—Mr. W. E. M. Bonn.
May. 6th.—Ontario Highway Policy—Mr. W. A. McLean.

The following are promised for next season:

Chippawa Hydro Electric Power Scheme—H. G. Acres.

Geology in relation to Engineering, Mr. C. W. Knight.

Hydro Radials, Mr. F. A. Gaby.

General Refining Practice, Mr. C. E. Dean.

Progress and development in design of centrifugal pumps, Mr. T. M. Jones.

New Toronto Union Station—Mr. J. R. W. Ambrose.

Design of Sewage Treatment Works—Mr. W. R. Worthington.

Pumps and Power—Mr. James Milne.

Reinforced Concrete—Mr. J. C. Krumm.

Mesopotamia—Capt. L. Wynne-Roberts.

Engineers in relation to Contractors—Mr. W. E. Douglas.

Forms for Concrete Work—Mr. T. T. Black.

Steel Forging and Heat Treating Furnaces—Mr. R. R. Knight.

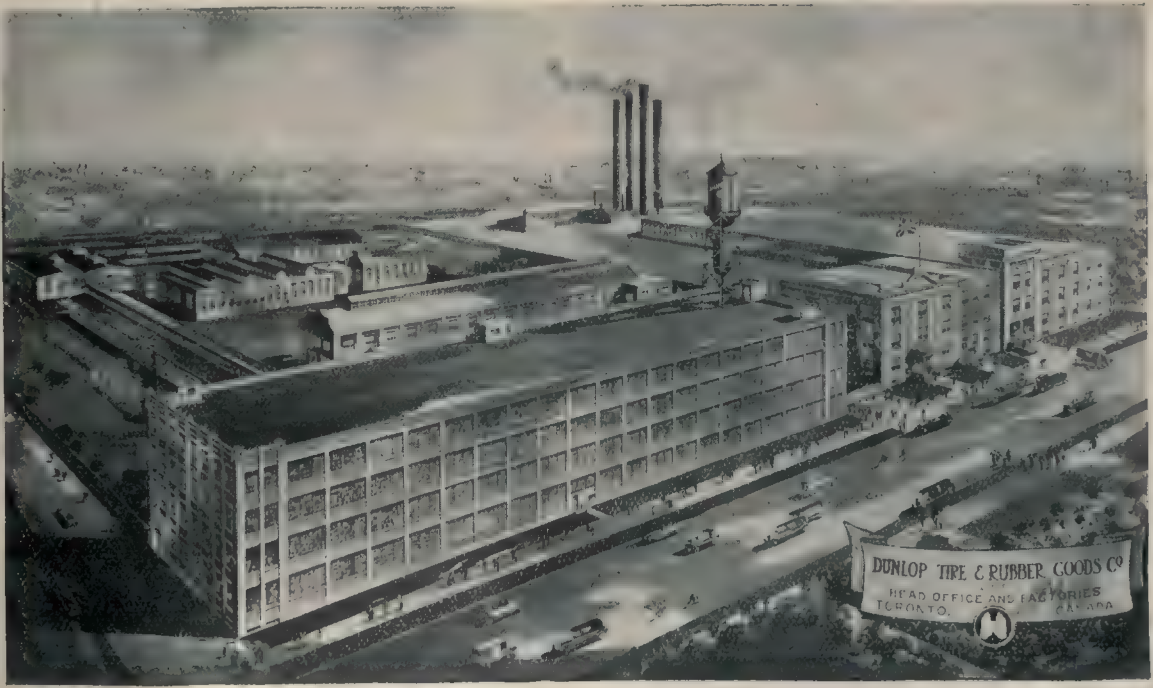
Purchase of Fuel on B. T. U. basis—Prof. L. M. Arkley.

Street Paving—Mr. Murray A. Stewart.

Toronto Gas Works—Mr. A. Hewitt.

Hydro Electric Power—Mr. T. H. Hogg.

Concrete—Mr. R. B. Young.



How works of Dunlop Tire & Rubber Goods Co., Ltd., Toronto, will appear when large extensions are completed

Unit Cost of Labor on Essex Border Sewer

Itemized Cost Data of Shaft and Tunnel Excavation, Pipe Laying and Backfilling on East Intercepting Sewer in Border Cities

By Chas. W. Tarr*

THE Essex Border Utilities Commission, composed of two members from each of the seven municipalities of Windsor, Walkerville, Ford City, Sandwich, Ojibway, and portions of the townships of Sandwich East and Sandwich West, bordering on the Detroit River opposite Detroit, Mich. in Essex County, Ont., having in charge, among other things, the disposal of the sewage for the Essex Border District, had plans and contracts prepared for sections of an intercepting sewer and in October, 1918, awarded contracts for the construction of the east intercepting sewer. Materials began to arrive and actual construction started on Oct. 17, 1918.

The east intercepting sewer serves, for the present, to discharge the sanitary flow from Ford City and Walkerville into the Detroit River below the existing Water Works intakes, and later will form a portion of a complete intercepting system, with an outlet at one point, where disinfection and later, purification facilities can be installed.

The line ran along Sandwich Street which follows the Detroit River and is fast becoming lined with business and industrial interests. Traffic on this street is much congested, especially through Walkerville and the plant of the Ford Motor Co. of Canada in Ford City. A trolley line extends along one and one-half miles of the line and a crossing under the main lines of the Grand Trunk Railway was necessary. The plans for this section of interceptor provide for a pumping station which is now under construction but was not included in this contract.

Quantity of Work

The work to be done consisted of building:

942	lineal feet	15 in.	Vitrified Pipe Sewer.
1469	" "	18 in.	" " "
1555	" "	20 in.	" " "
2585	" "	24 in.	" " "
2037	" "	30 in.	Segment Block Sewer
3709	" "	33 in.	" " "
254	" "	20 in.	Reinforced Con. force main

48 brick manholes with concrete base and cast iron frame and cover.

Two measuring chambers with Venturi tubes

Three regulating chambers at junctions with existing combined sewers.

The work fell naturally into three classes, viz: The main interceptor with manholes and force main; the two measuring chambers with their Venturi tubes; the regulators at existing combined sewers and connections for sanitary flow only. The two last classes of work were not large and of a special nature, and their cost is given as total only.

About 81 per cent. of the sewer was laid in tunnel and shaft excavation, the material being largely a blue knifing clay to which that method was especially adaptable. In order to delay traffic as little as possible, the interceptor was placed under the sidewalk or parking space wherever practicable. About one mile was placed directly under the sidewalk, which was disturbed only where shafts were located.

The force main crossing under the main line of the Grand Trunk, a double track railway with sidings, was laid in open cut, the two main line tracks being supported on stringers over caps on round piles. The other two crossings under spur tracks were made without special work, the usual cement envelope 4 in. thick, as specified by the Ontario Railway Board, being put around the pipe at all railroad crossings. Three crossings under the trolley track caused no inconvenience to the tunnelers.

A section of the work, 1843 feet long, with depths from 11 to 18 feet, was excavated by means of an Austin trenching machine. Back-filling this open cut trench was done with a team and scraper, using a long cable to span the trench.

At the start of the work, it was expected some difficulty would be encountered in securing labor but as the work progressed, sufficient men were available and the rates of pay were reduced, with the greater number employed at the lower rates.

Rates of Wages

The following table gives a representative list of workmen and their average rates.

	Rates per Hour	Maximum number employed per day
Foreman	$8.00-6.00 per day	3
Tunnelers	90-70c	5
Block layers	90-70c	4
Brick layers	90-70c	4
Laborers	65-45c	66
Teams	80-70c	9
Horse and Man	60c	4
Wagons only	25-40c day	10

Nearly all work done on lineal foot basis.

A large amount of work was done on a production basis which made for shorter hours and greater progress. The tunneler and shaft-digger, also the bricklayer on the manholes worked on this basis at the following rates:—

	Rate per lineal ft.	Maximum daily production
Tunneling	$1.35-.80	113 ft.
Shaft Sinking	$3.50-2.20	40 vert. ft.
Manholes	$1.25 per vert. ft.	122 ft.

The maximum force was employed during the two weeks ending Jan. 16, 1919, it being over three times the number employed in November 1918, when work was well under way and four times that at the end of may 1919, when the larger part of the work had been completed.

Shaft Excavation

Shaft sinking was done by hand, using picks, spades and grubs, the material being shoveled from platforms placed at vertical intervals of approximately seven feet. Generally the major portion of the material was piled alongside the shaft for backfilling. Two men worked together in the bottom, being paid for the number of vertical feet excavated. The platform and top men worked by the hour.

The shafts, spaced about 75 feet apart, averaged

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*Vice-president and general manager, Morris Knowles, Ltd., Consulting Engineers, Windsor, Ont.

5 x 8 feet in area, with depths from eleven feet to twenty-one feet. Eighty per cent. of the shaft excavation was in hard, yellow clay, requiring sharp picks to loosen it. All shafts were braced, using rangers 6 in. x 8 in. with lagging 2 in. x 8 in. spaced 8 in. apart. Where the depth of the sewer exceeded 10 ft. the 5 x 8 ft. shaft was used but in shallow excavation, an elongated, narrow shaft was used of about 15 feet in length, leaving about 35 feet between to be tunneled.

Tunnel Excavation

Tunneling was done by men experienced in that type of work; they clothed in oil skins and used short spades. The excavated material was passed back to a mucker who loaded it at the bottom of the shaft into a bucket holding about one-quarter cubic yard. From this point it was drawn to the top by a horse operated windlass, especially made for this work. Two shafts with four headings were worked simultaneously and required the following force and equipment:

4 tunnelers; 4 to 8 muckers; 2 top men; 1 horse and driver; 8 mud buckets.

The hoist used was a portable frame outfit, occupying a space about 6 x 10 ft., with a platform 5 ft. above ground level, on which a short pair of rails were fastened and a flat car operated. Two hoists were generally operated together, one of which was equipped with a vertical drum and horizontal lever to which a horse was hitched. Cables from this drum ran over sheaves and down each shaft, being so wound that as one was lowered the other was raised. The horse was equipped with a swivel yoke and could be readily turned to travel in either direction around the center of the drum. A mud bucket being filled at the bottom of the shaft was raised as an empty one was lowered in the adjoining shaft. The top man ran his transfer car under the full bucket and attached an empty bucket to the cable. The full bucket on the transfer car was pushed to the edge of the platform and emptied into a wagon. One pair of horses handled two wagons, leaving an empty one at the hoist while removing the loaded one to the spoil dump.

Pipe Laying and Backfilling

Block laying and pipe laying followed the completion of excavation between shafts, the heavier pipe being lowered by means of the usual type of "A" frame windlass, having a light wagon wheel on the end of the shaft and a friction brake. Backfill in the tunnel was done by the blocklayer or pipe layer with blue clay, packing it in by hand as each joint was laid. Backfill in the shafts was partially made by dumping wagon loads of material from the excavation ahead, through holes in platforms over the shaft openings.

Work Carried On During Winter

The feature of the work was that it was started in October and pushed to completion through the winter season, thus releasing the labor and equipment in June and July to take up the summer contracts.

Elapsed time, ...		267 days
Less Sundays		38 days
Total working days		229 days
Working days lost		
Armstice	2	
Christmas	1	
Rain	7¼	10¼ "
Total days worked		218¾

Length of work 12,551 feet or 57 ft. per day worked.

The largest cost item of the work was excavation, as the interceptor was laid at a depth of 12 ft. to 22 ft. with an average depth of about 18 ft. The following table gives itemized labor costs for shaft and tunnel excavation. This is actual cost, without profit or workmen's compensation and the considerable variation in unit prices is due to particular local conditions and to the necessity of varying the rates of pay to meet the labor conditions encountered.

Unit Costs and Data on Shaft & Tunnel Excavation

Shaft Excavation

	Segment Block			Vitrified Sewer Pipe		
Diam. Sewer in inches	33"	33"	30"	24"	20"	18"
Number of Shafts opened	52	13	31	39	19	9
Average Depth	10'-18'	18'-22'	14'-19'	15'-21'	19'-20'	12'-20'
Total cu. yds. Shaft excav.	966	406	835	805	394	152
Aver. cu. yds. per shaft	18.5	31.3	27.0	20.6	20.7	17.0
Total cost shaft excav.	$2787	$2125	$4809	$1913	$1254	$505
Average cost per shaft	$54	$163	$155	$49	$66	$56
Average cost per cu. yd.	$2.90	$5.20	$5.75	$2.38	$3.18	$3.30
Tunnel Excavation						
Length of tunnel	2295	728	1744	2289	1427	502
Aver. size	43 x 54"	43 x 54"	40 x 48"	34 x 48"	29 x 40"	29 x 40"
Cu. yds. per ft.	.50	.50	.40	.28	.25	.25
Total cu. yds.	1148	364	698	641	357	126
Total cost tunnel excav.	$6591	$1626	$5151	$5088	$2966	$1039
Aver. cost per lin. ft.	$2.87	$2.23	$2.95	$2.22	$1.89	$2.07
Aver. cost per cu. yd.	$5.74	$4.47	$7.48	$7.94	$8.30	$8.24

Pipe Laying Cost

The following table gives unit costs for laying pipe and backfilling shafts and open trench. These also are actual costs without profit or workmen's compensation. Wherever pipe was laid in tunnel, the cost includes backfilling because as each length of pipe was laid the opening above it, approximately 12 in., was immediately filled and tamped with blue clay.

The unit costs for backfilling are for shafts and open trench only, as the backfilling in tunnel was included in pipe laying as explained above.

Pipe Laying and Backfilling Costs

diam.	33"	33"	30"	24"	20"	18"	15"	20" Force Main
Pipe Laying								
Length of pipe	2799'	822'	1966'	2540'	1535'	1446'	928'	252'
Total cost pipe laying	$2710	$933	$2592	$1699	$864	$482[1]	$131[2]	$241
Cost per foot	$ .97	$1.14	$ 1.32	.67	.56	.33	.14	.96
Backfilling								
Total cu. yds.	708	334	725	762	355	1113[3]	979[4]	113
Total cost Backfilling	$671	$120	$173	$331	$325	$570	$733	$109
Cost per cu yd.	.95	.36	.24	.43	.63	.51	.75	.96

1— 61% in open trench.
2—100% in open trench.
3— 88% in open trench.
4—100% in open trench.

Cost of Work

This work was done on the basis of actual cost plus a fixed fee on a sliding scale. The fixed fee for completing the work was $12,000, being about 10 per cent. of the estimated cost of the work by the contractor. This fee was increased by 25 per cent. of any saving the contractor made on his estimated cost, and decreased by 10 per cent. of any amount he exceeded his estimate.

The total labor cost, exclusive of workmen's compensation which runs about 2½ per cent. of the payroll and profit, was as follows:

			Per cent. of labor cost
Shaft excavation	$13,393	$3.77 cu. yd.	21.3
Tunnel "	22,461	6.75	35.8
Backfilling	2,932	.58	4.6
Machine & open cut .. .. excavation	2,581		4.1
Pipe laying	9,652		15.4
Manholes	2,780	$58.00 each	4.4
Paving	1,187	Sq. Yd.	1.9
Removing supplies & ... cleaning up	7,088	Cu. Yd.	11.2
Pumping, misc. repairs,.. etc.	780		1.3
	62,854		100.0

The total cost of the work is shown in the following table:

		Per cent. of whole cost
Labor from above table	$62,850	50.2
Regulators (Labor)	4,500	3.6
Hauling Materials	2,150	1.8
Materials & equipment including Workmen's Compensation ...	44,000	35.2
Profit	11,500	9.2
	125,000	100.0

Contractor and Personnel

The interceptor was constructed by Merlo, Merlo & Ray, Limited, contractors, of Walkerville, Ontario. The interceptor was designed and the construction work supervised by the firm of Morris Knowles, Limited, whose president, Mr. Knowles, is chief engineer for the Essex Border Utilities Commission.

The Suitability of Wooden Houses for England

Author Believes That the Frame House Can Be Satisfactorily Adapted to English Conditions — Suggests Practical Test

By Thos. Adams*

WHETHER or not the wooden house is suitable for English climatic conditions is a matter not likely to be settled by theoretical discussion. Practical demonstration is needed on a larger scale than has hitherto been attempted. That the isolated wooden cottage was suitable and was more economical than a brick or stone house for rural districts was well established before the war. In many English agricultural districts, weather-boarded cottages existed that were both charming in appearance and adapted to comfort.

I lived in a small wooden house—which is still occupied—in London from 1908-11. That house had been standing for about a hundred years It was warmer than a brick house, and showed no more signs of decay than a brick house of the same age. In the same neighborhood there are many old weather boarded cottages, all occupied and, because of their picturesque character and setting, more attractive to tenants than the wooden brick cottages too often erected in dreary rows. The Chief Architect of the Ministry of Health has lived for many years in a wooden house at Hampstead.

Durable, if Well-Built

The fact is that when a wooden house is well-built, of well-seasoned lumber, it is as durable as need be. With regard to fire insurance in England my house was insured for the same premium as a brick house.

However, these houses, and also farm cottages, are in open surroundings. The fact that they are reasonably safe does not mean that it would be safe to erect wooden houses in rows—and usually working men cannot afford to live in anything but rows or groups.

It might be agreed that even if wood is cheaper than brick, and detached or semi-detached wooden houses are not an excessive fire hazard; the fact that brick houses can be safely erected in large groups does away with all the advantages of economy and rapidity of erection of wooden houses. Against this argument however, would it not be a good thing to get away from the fashion of erecting houses in long rows in England? If wooden construction will help to do so without serious disadvantages, would that not make it well worth while to use more wood?

Many of the pros and cons relating to wooden construction have already been discussed in English periodicals. It is unnecessary to continue discussing things so obvious as that wood must be well-seasoned, and that it should only be used where open development of the land is practicable. The discussion of technical aspects of wooden construction should be left to the architects and town planners who would be employed to apply and adapt the construction to suit English conditions.

The important point at the moment is that houses are urgently needed and that the use of wood for house-building has led to rapid and convenient methods of construction in Canada and that the cold climate and scarcity of coal have caused Canadians to be up-to-date in heating appliances.

A demonstration of the merits of the wooden house in England is needed, not only to show under what conditions wood may be safely used but also to indicate the methods of rapid building and economical heating that have developed in Canada.

Among the points that have been discussed, and regarding which there still appears to be much doubt in official minds, are two, namely, the suitability of the frame house to the English climate and the extra fire risk of the wooden house.

Suitability of Frame House to English Climate

There probably are no cities in Canada that have more wooden houses than Halifax, Vancouver and Victoria. Mr. A. G. Dalzell, who has had extensive British and Canadian experience, says that the climate of Halifax is comparable to that of England, the actual rainfall being greater. "The rainfall in Vancouver," he says "is greater than in England, while in Victoria strong winds combined with rains are not uncommon." Many of the houses in Halifax are over a century old.

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*Town planning advisor to the Commission of Conservation.

In the great explosion 1917 the brick houses stood up no better than the wooden houses. Wooden houses have also been standing in New England for over a hundred years.

Mr. W. D. Cromarty, the chief architect in the Housing office of the Canadian government, who was trained in an English office, says: "My opinion is that for most parts of England the frame house is quite suitable from the climate standpoint. There may be districts as, for example, in the Yorkshire moors where the force of the driving rains can only be successfully withstood by stout stone walls. These are however more or less exceptional."

Fire Risk of Wooden Houses

With regard to fire risk, this aspect of the matter can best be illustrated by quotations from "Fire Waste in Canada" by Mr. J. Grove Smith, of the Commission of Conservation and formerly of England:

"During the four years 1912-1915 there were fires in 10,791 brick, stone or other solidly constructed buildings, with a loss of $17,537,143 on the buildings and $32,405,836 on the contents. In 22,727 frame buildings there were fires with a loss of $12,167,773 on the buildings and $13,470,289 on the contents. The number of fires in frame buildings, therefore, exceeded those in brick buildings by 112 per cent., but the amount of loss was only one half as great.

"In a general way, it may be assumed that almost 70 per cent. of existing buildings in Canada are of frame construction.

"The assertion that fires are more numerous in Canada than in Europe because of the greater prevalence of wooden buildings is not strictly in accordance with the facts. Were the frequency of fires thus affected by construction their numerical ratio to population in Canadian cities should have decreased of recent years. Since 1890, practically all the more important cities have enacted measures prohibiting frame buildings and shingle roofs within at least a portion of their areas. Despite the progressive structural betterment thereby effected, the number of fires in these places has shown no appreciable decline.

"Brick walls merely form a non-inflammable shell which is powerless to retard the internal spread of fire. Wooden joists, floors and partitions, unprotected wall and floor openings and hidden spaces between joists and studding are invariably the same in both brick and frame buildings.

"The loss by fire (in Canada) is chiefly ascribable to (a) carelessness due largely from a sense of security created by the present system of fire insurance; (b) faulty building construction; (c) arson; (d) lack of adequate fire protection laws; such laws as exist being poorly enforced.

Methods and Speed of Erection

Mr. Cromarty reports to me as follows on the subjects of methods and speed of erection and form of construction:

"The plans contained in the Manual issued by the Ministry of Health in England might be used as a basis and elevations suitable to frame construction designed. After approval by the Ministry these drawings could be distributed to firms desirous of specializing in ready cut houses. The foundations would be prepared in advance and I am convinced that such houses could be ready for occupation six weeks after the materials were delivered on the site.

"There would probably be less time lost in the erection of frame houses during inclement weather; this is a small point during ordinary building operations, but when great numbers of houses are being erected it might prove of some consequence.

"The same type of general construction as is in use in Canada should be adopted. I suggest shingles for the outside wall covering, not exclusively of course, clapboards and roughcast to be used also. Walls covered with shingles, however, afford greater protection against heat and cold than do clapboards, as there are usually three thicknesses at all points, while with clapboards there is practically only one. (This is in addition to sheeting of course). Shingles also expand and contract more readily without cracking than do clapboards. Shingles require staining only and when stained produce texture effects which are wanting in the painted clapboard wall.

"For the roof covering shingles on asbestos paper would probably be found cheaper than slates on account of the lighter roof timbers required, and certainly a shingle roof is more pleasing than one constructed of the cheaper qualities of Welsh slate.

"While in many of the recent plans of the small English house the bathroom is shown on the ground floor, it would appear from the views set forth in various non-technical papers that there is a widespread desire to have it on the same floor as the bedrooms. The frame house lends itself more readily to this as it is not necessary to have the first floor partitions immediately over those of the ground floor as is required with brick partitions.

"The omission of fireplaces from the bedrooms would effect a very considerable saving in cost. They afford a means of ventilating the rooms it is true, but a much less expensive method could be devised for that purpose. Very rarely indeed are they used for fires, and the omission of the fireplace from one bedroom (as in the majority of the plans of the Ministry of Health) would seem to weaken the argument as to their necessity.

"The type of kitchen stove used in Canada, and the method of obtaining hot water by means of the range boiler are both worthy of consideration for use in the English cottage. A laundry tub fixture would, from a labor saving point of view, be an improvement over the existing copper.

"The chief concern of one interested in housing must, in the matter under review, be the speedier provision of houses where they are so urgently required. The frame house is likely to accomplish this."

A Canadian Village in England

There are many features in Canadian methods of planning and laying out land for residential purposes that need be considered in England. The extensive use of wooden buildings necessarily affects such planning. The greater adaptability of wood for building makes building by instalments possible. Frequently an existing handsome house began as a small cottage. There is no doubt that greater warmth can be secured by the insulated wooden walls than by solid brick

England cannot afford to waste time in studying these matters without guidance from those who have architectural and other experience in both countries. The conservation of public authorities in regard to methods of building construction will inevitably

Canada's Contractors – C. B. Jackson

Mr. C. Blake Jackson, President of the Jackson-Lewis Co., Ltd., contracting engineers, Toronto, was born in Petrolia, Ont., and received his early education at the public and high schools of that town. Later he entered the University of Toronto, and took a course in engineering at the Faculty of Applied Science and Engineering. He first went into the construction business with his father, as junior member of the firm of R. Jackson & Son, Petrolia, in 1901, and remained four years in that capacity. In 1907-08 he was superintendent for the O'Boyle Construction Co., North Bay. Leaving this position, he determined to try his fortune in the States, and went to Chicago, where he was appointed superintendent for the firm of J. P. & J. P. O'Connor. He changed again in 1909 and went to the C. Everett Clark Co., of Chicago, in the capacity of Assistant to the President, which position he held until the year 1913. He then returned to Canada and, in partnership with Mr. Lewis, organized the Jackson-Lewis Co., Ltd., with headquarters in Toronto. Mr. Jackson has since been president of this concern, which has carried out many important works in Toronto and the vicinity. Among the outstanding undertakings which the Jackson-Lewis Co. has carried out are: the National Cash Register Plant, Toronto; Farmer's Dairy Buildings, Toronto and Napanee; the Regent Theatre, Toronto; Canadian Aeroplanes plant, Toronto; several buildings at Whitby for the Military Hospitals' Commission; Dominion Orthopaedic Hospital, Christie St., Toronto. The firm is now also engaged in building the large new Pantages Theatre in Toronto.

Mr. Jackson has been active in organization work, having been president of the general contractors' section of the Toronto Builders' Exchange since its formation, and, as announced elsewhere in this issue, has now been elected President of the Toronto Builders' Exchange for the year 1920, in succession to Mr. A. D. Grant. Mr. Jackson has shown a keen interest in the solution of the problems which affect the building industry, particularly the one big problem—labor. He has been a member of the Joint Industrial Council of the Toronto Building Trades, an organization based on the Whitley plan, which has for its object the improvement of the relationships between the builders and their employees.

International Press Photo
Mr. C. Blake Jackson

This council has accomplished valuable work in the elimination of friction and the settlement of disputes before they reached the striking point, and Mr. Jackson is a firm believer in the principles of co-operation and arbitration which it seeks to embody. He represents the broad-minded viewpoint and the ideals of efficiency of the modern Canadian contractor-engineer.

make for delay. It would be possible to select a site in a district where considerable freedom of action might be permitted, and on which a Canadian Garden Village could be erected. Such a village might do more than fulfill the material requirements of a practical demonstration in housing; it might have an educational and spiritual value in making English people familiar with Canadian habits and home life regarding which there is so little knowledge.

The village might be given some significance as a memorial to Canadian achievements in the war, and in other ways could make for a closer understanding between the mother country and her greatest daughter.

From the point of view of Canada it is desirable that the features of the wooden frame house should be brought before the housing authorities in England. But if the interests of Canada were the sole interests to be considered it is not likely that much progress would be made in developing the Canadian lumber industry in Britain. The industry so far as it relates to housing can only be successfully developed on its merits, and the first thing to be done is to show that these merits exist. Those who are interested in the sale of Canadian lumber in England cannot expect to influence British trade until a demonstration is made both of the value of wooden houses and of Canadian methods of erecting them.

Big Demand for Metal Roofs

"It's an ill wind that blows nobody good," but, strange as it may appear, the cyclone which swept over certain parts of the province of Ontario in the early part of December last turned out very profitably for the Galt Art Metal Company. In conversation with Mr. Lutz, general manager, he stated that a number of farm barns in the vicinity of Galt had lost their wooden roofs in this storm, and, on account of the cost of replacing with shingles being so high today, most of these farmers had substituted metal roofing, which, in addition to lower cost, has many added advantages.

Have you made your arrangements yet to be present at the convention of the Provincial Builders' & Supply Association at the King Edward Hotel, Toronto, Feb. 10-12? There is every prospect of a very pleasant and profitable time. Matters of the greatest importance to the trade will be discussed and dealt with, and provision is also being made for entertainment features of an attractive character. A visit to Toronto Feb. 10-12 will be good business.

Mainly Constructional

East and West—From Coast to Coast

A new medical building, to cost, when completed, $750,000, is to be erected for the University of Alberta.

The Board of Education of Brantford, Ont., have requisitioned the City Council for $350,000, of which $100,000 is for a Public school in the northern part of the city, and $250,000 for a collegiate institute.

The Finance Committee of the County Council of St. John, N.B., have ordered that $161,000 be included in the 1920 estimates for the erection of a new home for nurses in connection with the general public hospital.

According to a recent statement of Hon. Walter Mitchell, Provincial Treasurer of Quebec, requests totalling approximately $8,000,000, have been received from various municipalities throughout the province under the housing loan scheme.

Four public schools and two high schools are embraced in the program of new buildings under the consideration of the Board of Education of Toronto, while it is proposed to add 53 rooms to existing public schools throughout the city during the present year.

Public notice appeared in a recent number of the Quebec Gazette, of the incorporation of several private individuals of Coaticook, Que., who have taken over the business of the Coaticook Water Company, under the name of the City Water Company. The new firm is capitalized at $149,000.

According to the report handed to Mayor Porter, of Vancouver, by W. Englehart, collector of water rates, the total revenue from the water system amounted to $216,398.89 during the past year, while the cost of the system for the same period amounted to $180,726,08, leaving a surplus of $35,672.81.

E. C. Halsey, sales manager of the Imperial Oil Company's branch at Regina, Sask., recently stated that it is the intention of his company to spend in the neighborhood of $300,000 on the construction of tanks, warehouses, pump houses, filling stations, etc., in Saskatchewan during the present year.

The Saskatchewan Government has been asked to furnish legislation empowering the creation of irrigation districts in this province on the local benefit assessment plan, somewhat similar to that in operation in Alberta. Hon. S. J. Latta promised that the matter would have very earnest consideration.

Hon. P. J. Veniot, Minister of Public Works for New Brunswick, adressed the Commercial Club at Halifax, N. S., recently, outlining what has been done in his province in the way of road building and appealing for the co-operation of the people of Nova Scotia in changing the rules of the road and obtaining more advantageous terms of Federal aid.

The Hull Technical School Commission, of Hull, Que., has been the recipient of a generous gift in the form of a site for their proposed new Technical school. The property which is situated on Wright St., between Leduc and St. James Sts., has been turned over by the owners, the Catholic School Board, to the Commission and actual construction on the new school will be commenced, it is anticipated, next May.

The Dominion Steel Products Co., of Brantford, Ont., will build a new foundry in that city which will cost in the neighborhood of $150,000. The property secured for the new foundry adjoins the site of the present plant. The new building will be 100 by 160 feet, of brick and steel construction, and will be used for the production of high-grade steel castings for machinery manufactured in the present plant.

Col. G. H. Fitzpatrick, chairman of the Vancouver Harbor Commission, speaking recently on the development work at Burrard Inlet, announced that the new government pier at this point will be one of the most modern structures of its kind on the Continent, and will cost in the neighborhood of $4,000,000 to construct. He further stated that actual work on the new pier, which will be situated between Hastings Mill and the government wharf, will probably be commenced within the next six weeks.

A very interesting and instructive address was given by Mr. Frank Barber, of Toronto, recently, before a joint meeting of Ottawa Branches of the Ontario Association of Architects, Town Planning Institute of Canada, and the Engineering Institute of Canada, at Ottawa, on the subject "Bridges; Their Relation to Architecture and Town Planning." The meeting, which was held in the Public Library, was presided over by Mr. Noulan Cauchon, who expressed the hope that this first joint meeting would be the beginning of a good movement.

Personal

Mr. P. M. McPherson has been appointed building and plumbing inspector at Guelph, Ont.

The name of Lt.-Col. W. N. Moorehouse, D.S.O., is proposed as a successor to Mr. W. W. Pearse as city architect of Toronto. Col. Moorehouse is a graduate of the Faculty of Applied Science and Engineering, winning the Kennard-Thompson prize as head of the 1904 class in civil engineering. He has had experience in practical construction work with the Northern Aluminum Company at Shawinigan Falls, and was also chief engineer for the architectural firm of Sproatt & Rolph for seven years. During the eighteen months prior to the war he was engaged in private practice as an architect, but entered military service immediately upon the outbreak of war. Col. Moorhouse's application for the position of Toronto City Architect is supported by recommendations from Brig.-Gen. C. H. Mitchell, A. Frank Wickson, President of the Ontario Association of Architects, and Messrs. Sproatt & Rolph, architect, Toronto.

Obituary

Mr. William Welsh, builder, of 10 Prust Ave., Toronto, died recently in his sixty-seventh year. Mr. Welsh was born in Devonshire, England, and came to Canada when he was twenty-eight years of age, residing in Hensall, Ont., until seven years ago, since when he has resided in Toronto.

Trade Incorporation

Ontario Cement Co. Ltd., with head office at Brantford, Ont., capital $600,000.

Martin, Limited, with head office at Montreal, capital $50,000, to carry on the business of general contractors and builders.

North Toronto Homes, Limited, with head office at Toronto, capital $40,000, to carry on the business of builders and real estate dealers.

J. A. Grant & Co. Ltd., with head office at St. John, N. B., capital $100,000, to take over the business of Grant & Horne, contractors and builders.

Central Foundry, Limited, with head office at Georgetown, Ont., capital $40,000, to carry on the business of foundrymen, machinists, builders, etc.

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks, Sewerage and Roadways

Chatham, Ont.
Alex. J. Templeton, reeve for Chatham Township, Township Office, Scane Block, Chatham, is receiving tenders until 11 a.m. Feb. 25th for excavation in connection with improvements to Bear Creek drain. Plans with clerk, A. McArthur, Tupperville, Ont., and engineer, W. G. McGeorge, Chatham.

Enniskillen, Ont.
Lloyd Bourne, Commissioner, Enniskillen, is receiving tenders until 4 p.m. Feb. 20th for digging, laying tile and filling drains for Enniskillen Township Council. Plans at Township office and residence of Commissioner.

B. J. Warren, commissioner, Enniskillen, Ont., calls for tenders until Feb. 20th on drains for Enniskillen Township. Plans at Township office and residence of Commissioner.

Matane, Que.
By-law passed authorizing construction of sewer and waterworks for Town; cost, $70,000. Tenders will be called shortly. Engineer, F. Trenon, Chicoutimi; alderman, L. F. Chouinard.

Montreal, Que.
R. S. & W. Lea, Consulting Engineers, 10 Cathcart St., have made report re utilizing aqueduct canal as source of water supply for Montreal. Administrative Commission will study report and make decision shortly. Engineer for City, A. E. Doucet.

Ottawa, Ont.
Tenders received by secy. Bd. of Control until March 1st for C. I. Pipe for City. Mayor, Harold Fisher. Specifications at City Engineer's Office.

Sewer costing $18,000 will be constructed by city. Tenders will be called in March for 18 in. tile pipe. Mayor, Harold Fisher; Commissioner of Works, A. F. Macallum.

City will have specifications prepared for the supply of asphalt and liquid asphalt for 1920. Tenders will be called shortly. Mayor, Harold Fisher.

City plans construction of watermains and services; cost, $50,000. Mayor, Harold Fisher; commissioner of works, A. F. Macallum.

Rimouski, Que.
Town plans to construct sidewalks and to pave streets. Mayor, E. Moreault; secy.-treas., Georges d'Auteuil.

Strathroy, Ont.
Town Council will consider making improvements to road on Carrie & Caradoc Sts. Chairman, D. A. Graham.

Toronto, Ont.
W. A. McLean, Deputy Minister, Parliament Bldgs., Toronto, calls for tenders until noon Feb. 2nd for supply in lots, f.o.b. railway stations in Southern Ontario, of the following road-building equipment for Provincial Dept. Highways: 2-¾ yard steam shovels (traction or caterpillar tread prices to be submitted); 40 railway breaker plows; 40 heavy land plows; 300 No. 2 drag scrapers with runners, to weigh approximately 95 lbs. each; 6-4 horse graders. Delivery on above equipment must be complete on or before May 1st, 1920.

W. A. McLean, Deputy Minister, Provincial Dept. Public Highways, Parl. Bldgs., receives tenders until noon Feb. 9th for clearing, grubbing, earthwork, rock work, construction of concrete structures, building guard rail, etc., on provincial highway in Pittsburg Township. Plans at offices of Resident Engineer, Gananoque., City Engineer, Kingston, and Parliament Bldgs., Toronto.

Walkerton, Ont.
Town Council will consider construction of sewers shortly. Mayor, Mr. McNab.

CONTRACTS AWARDED

Dresden, Ont.
Work will start shortly on construction of waterworks system, mains and tanks costing $16,000 for Town: Contract for 60,000 gallon elevated steel tank, $8,700, Canadian Des Moines Steel Co., Inches Ave., Chatham, Ont.

London, Ont.
Wm. H. Harvey, Deseronto, Ont., has general contract for grading and road work at hospital for Dominion Dept. Public Works.

St. Barnabe De Gatineau, Que.
Alexandre Carrier, St. Tite, Que., has general contract for gravelling road for Municipality; cost, $12,500.

St. Johns, Que.
Work will start shortly on construction of sewer for Town; work under supervision of Town Inspector E. Lanier. Stone 8 in. diameter for sewer foundation supplied by Messrs. Lemaire, Roy, Parent, Grenier.

Railroads, Bridges and Wharves

Chicoutimi, Que.
Quebec & Chibogaman Rly. Co. have been granted permission to construct railroad from Quebec to Chibogaman. President, Paris Costo, engineer, J. F. Trenon, both of Chicoutimi.

Edmonton, Alta.
Grand Trunk Pacific Rly. plan to spend $3,000,000 on construction of car shops shortly. Western Manager, W. P. Hinton, Winnipeg.

Harriston, Ont.
Work will start shortly on erection of station for C. P. Rly., head office, Montreal, Que. Supt., Mr. Williams, London, Ont.

London, Ont.
London & Port Stanley Rly. Commission and City Gas. Co., Colborne St., plan to extend railway to gas works and to construct trestle.

Moose Jaw, Sask.
C. P. Rly. plan to erect three storey station, brick construction. Address Manager, Western Lines, Winnipeg, Man.

Pabos, Que.
Pabos, Amqui & Edmundston Railway Co. have applied to Dominion Gov't. for permission to construct railway from Pabos, Que., to Edmundston, N. B.

Parry Sound, Ont.
Town Council is considering the construction of four arch concrete bridge on Cascade St. Mayor, Mr. Hall.

St. Malo, Que.
Company will be incorporated shortly to construct and manage electric railway from St. Malo to Limoilou, Que.; cost, $500,000. Promoters, John T. Ross, St. Louis Rd.; J. G. Scott, 80 St. Louis Rd.

Thamesville, Ont.
L. A. Pardo, County Road Supt., Chatham, calls for tenders until Feb. 6th for complete dismantling of Duffis bridge for Kent County Council.

Three Rivers, Que.
A number of citizens have had John Bourgeois, engineer, prepare plans for steel bridge over C. P. R. yards and have suggested that City Council pay half the cost and C. P. Rly. the other half. Cost, $125,000.

Toronto, Ont.
Bd. of Control has instructed Commissioner of Works, R. C. Harris, City Hall, to buy street cars to the value of $200,000 in open market.

E. L. Cousins, Chief Engineer and Manager for Toronto Harbour Commission, Harbour Commission Bldg., will receive tenders until Feb. 6th for harbour head walls.

CONTRACTS AWARDED

Cottonwood River, B. C.
Northern Construction Co., Prince George, B. C., have general contract for two stations for Pacific Great Eastern Rly. Erection of new bridges is planned.

N. D. Auxiliatrice De Buckland, Que.
Municipality placed general contract for concrete and steel bridge costing $7,000 with Gauvin & Lessard, Bosse Block, 147 Mountain Hill, Quebec.

Public Buildings, Churches and Schools

Barrie, Ont.
St. Andrew's Church plans to erect Sunday School; cost, $10,000. Chairman of Committee, Dr. E. L. Brerton. Money has been raised.

Belleville, Ont.
Bd. of Education has requisitioned the City Council for $100,000 for erection of public school. Chairman, Sites, Bldgs. and Repairs, Arthur McGee.

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Conference of Ontario Builders Will Seek to Harmonize the Industry

THE present is a time of crisis for the industries of Canada, not because they are facing disaster, but because they are faced with two alternatives, and their choice is going to profoundly affect the country's future prosperity. These alternatives are: unity of aim and concentration of effort, which will lead on to national success, and diversity of aim and dissipation of effort, which will keep us forever in a turmoil of industrial unrest and uncertainty. We are not among those dismal prophets who declare that the nation is skating on thin ice which may break through at any moment and engulf us in economic ruin; Canada's resources are so great that we could not actually bankrupt the country, even by the wildest profligacy, in a generation. But we do believe that if greater harmony is not secured between employer and employee, between firms engaged in the same line, between the various branches of each industry, and between all industries as units in our great commercial structure, then we have before us troublous times of unemployment and stagnation, or, at best, of unrest and insecurity.

This greater harmony can be secured through a determined effort. Many of the men in the building industry realize the situation and they are doing their best to bring together their fellow-contractors, in order to discuss their problems and, if possible, find a solution to them. The Provincial Builders' and Supply Association of Ontario is among those organzations which are seeking to foster and increase the spirit of co-operation. Their convention at the King Edward Hotel, Toronto, Feb. 10-11-12, is a master effort to boost organization throughout the province and find the means of solving the difficulties which are facing the builders and contractors of Ontario at the present time. They want the co-operation of every one in the business—co-operation itself provides the solution for many of our problems—and it will be to the interests of each individual builder and contractor to come to the convention in Toronto, and learn what has been accomplished and what can be accomplished through organization.

Give Wide Publicity to Government and Municipal Needs

THOSE who have been willing to criticize the new Ontario Government have found their opportunity in the recent purchase of certain equipment (trucks, rollers, etc.), by the Minister of Public Works & Highways, without following the usual procedure of calling public tenders. We are very loath to find fault with any form of executive until it has been given a fair trial, but it may not be out of place to express an opinion and to point out that the very thing for which the new party is supposed, and hoped, to stand is "a square deal," and that this can never be brought about unless, in so far as is humanly possible, everybody is given an equal chance. This condition, again, can only be reached through a course of free and open publicity, where the wants of the government are made known to all those who are in a position to supply those wants.

In the particular case that has been given so wide publicity lately, it is more than likely that the Hon. Mr. Biggs failed to realize that he was no longer a private individual doing as he liked with his own. His present position, however, is that of a trustee, spending the money of the people of his province with the single aim of getting the best possible value. Friendships can no longer count, nor personal impressions of the value of this or that equipment. Nothing counts now but facts, and these can be obtained only through the widest possible advertising, so that everybody interested may have an opportunity to present his case. The final result may or may not verify the minister's first impressions—that is of no material importance. What actually does matter, however, is that the public—the man who pays—is satisfied.

And what is true of Provincial government purchases is no less true of municipal purchases—whether in the form of machinery, supplies or labor contracts. It is not only the right course to publicly and widely advertise all municipal needs, but it is the most economical means of supplying those needs. Lack of competition is the cause of high costs. Sometimes, of course, lack of competition is due to a shortage of the supply, but that is only an added argument why every possible bit of competition should be introduced. This is not possible except through the widest publicity in the calling of tenders. It is the only fair way for those who have to pay. It is the only fair way for those who sell.

The process of calling tenders in a number of our municipalities is a farce and is merely designed to deceive the electors. Recently a case came to our attention where very limited publicity had been given to certain equipment required by the municipality and the question was asked—why? The answer was "Oh, the contract was really let before tenders were called at all." "Then why call tenders at all?" was asked. "Oh, our by-laws require that as a formality." A formality that pulls the wool over the eyes of the dear public and, at the same time, makes them pay for the wool.

Why can't these things be done "on the square?" It would pay.

Federation of Construction Industries to Tackle Urgent Problems

THE first annual meeting of the National Federation of Construction Industries will be held on March 24-25, 1920, at the Hotel Sherman, Chicago, Illinois. It promises to be of extraordinary interest and fundamental concern to everyone engaged in construction. Invitations to be present are extended to every national, regional and local association, and to all producers, manufacturers and distributors of construction materials, machinery and supplies, contractors, architects, engineers, and financial interests concerned with construction.

The Federation was formed for the purpose of extending construction and improving conditions in the combined industry. It is intended to co-ordinate the several divisions of the industry by promoting close co-operative relations between producers, manufacturers, distributors, contractors, architects, engineers, realtors, financiers, and other construction interests, thus providing a united organization which will mobilize the entire strength and experience of the industry.

Among the subjects of vital interest to be discussed at the annual meeting by the best known national and international authorities are:

1. Freight Traffic as affecting the construction industry, freight rates, economical packing and handling in the shipment of construction materials.

2. Standardization in the Construction Industry.—During these times of high prices of material and labor and increased demand for production, standardization holds out to the industry the one great hope for making production approximate demand at a non-prohibitive price.

3. Foreign Trade.—Construction interests are realizing and grasping as never before the opportunities for branching out into world trade. Are you taking advantage of them?

4. Financial Relations.—Adequate financing of construction operations will be given serious consideration. The questions of Federal home loans, exemption from taxation of certain of the income from mortgages on real estate, etc., are before us.

5. Jurisdictional Awards.
6. Housing.
7. Americanization.

Establishment of Steel Concern in Toronto Will Give Impetus to Allied Industries

THE establishment of Baldwins Canadian Steel Corporation in Toronto is an event of great importance to the city and to the province at at large. The plant, of which the principal product will be tinplate, will be the first of its kind in Canada. The tinplate requirements of the Dominion at the present time are estimated at 200,000 tons per annum, and Baldwins are planning to take care of a large percentage of this demand immediately upon completion of the plant, their projected initial capacity being 150,000 tons per annum. Later, as conditions warrant, it is proposed to extend the plant and, one day, it is expected to equal or exceed any of the company's plants in the Old Country or throughout the Empire.

Baldwins are taking over the old plant of the British Forgings, Ltd., and adapting it to their purposes. At the present time they are using the electric furnaces in the foundry to turn out steel castings in connection with their mills and machinery. They are also erecting large new buildings in which will be installed rolling mills, cold rolls, furnaces, pickling ovens, etc. Work on the erection of the steel for these buildings is just being started, and a description of the heavy concrete foundation work, which involves several interesting features, appears elsewhere in this issue, together with details regarding the company's plans.

This new industry will mean a great deal to Toronto and to Ontario and the Harbor Commission, which has been instrumental in inducing Baldwins to locate in the new industrial area, deserves great credit. Allied industries will undoubtedly spring up and an impetus will be given to the growth and industrial activity of the city, as a result.

British Columbia Architects and Engineers Seeking Recognition

WITH the object of definitely establishing the status of their professions, of safeguarding the public against misrepresentation and also with the object of placing themselves on an equal footing with those engaged in the same professions in other provinces and states, architects and civil engineers of British Columbia will seek the passage of private bills at the coming session of the provincial legislature, providing for the registration of all engaged in these callings in the province. Should the legislature give its approval to the bills, with the passage of them it will become illegal after a certain date, for any architect or engineer to practice in the province unless he is in possession of a certificate of registration, granted under the conditions laid down in the acts.

While the architects have an association among themselves, this association has no standing such as is possessed by the legal, medical or dental professions, and it is with the object of placing the profession as nearly as possible on the same footing as these other professions that steps are now being taken.

The granting of a certificate to an architect, under the provisions of the act, will mean that he is properly qualified to undertake work in which, it is pointed out,

Canada's Engineers—S. R. Cound

Canada has received an important addition to the ranks of its engineers in the person of Mr. S. R. Cound, manager of Baldwin's Canadian Steel Corporation, which is establishing a large plant in Toronto. Mr. Cound was born in a town in South Wales, called Port Talbot, on the Bristol Channel. His early days were spent here in the environment of iron and steel. He received his education first at the National Schools, under one of the ablest masters of that time, afterwards at Long Ashton School, Bristol, and finally at Thistleboon House School, Swansea. At an early age he determined to enter the iron and steel trade, and served his apprenticeship with the Millbrook Iron and Steel & Engineering Co., the best engineering company of that period, who particularly specialized in rolling mill plants, and were considered the ablest millwrights in the whole of South Wales. The work turned out from these shops is found today in many parts of the world. Mr. Cound, as an apprentice, worked right through the whole of the shops—pattern making, foundry, machine shop—and finally entered the draughting room. Shortly afterwards he was engaged by the firm to remodel one of the oldest tinplate works in South Wales, and from then forward Mr. Cound has made the manufacture of steel and tinplate his life's work. In fact his early days, even as a boy of 12, were spent amongst the refineries and Bessemer plants. He was later engaged by the Grovesend Steel & Tinplate Company, as assistant engineer, and during the five years at these works, extensive new plant was installed and four open-hearth furnaces laid down. This work being completed, this firm had Mr. Cound take up the reorganization of their foundry and engineering works. He afterwards left South Wales for Moscow, Russia, where he occupied a very important position in the management of a large steel, sheet and tinplate plant. Mr. Cound designed and laid down, and afterwards successfully operated, this plant, which was considered the finest sheet and tinplate plant in the world, holding the world's record for output in light gauged sheets. It is Mr. Cound's ambition that Canada should beat even this. Mr. Cound and his family left Russia when conditions in that unfortunate country became unbearable, but for the fourteen years he spent there he can only recollect all that was good and pleasant of the Russian people. On his return to England he was engaged by Messrs. Baldwin's, of South Wales, on their Margan Works erection, a plant which deals with the iron ore, and all processes in the manufacture of coke—its by-product; pig iron, re-smelting of pig iron to steel; large rolling mills for rails; heavy sections for structural work and ship-plates. Mr. J. C. Davies, managing director of Messrs. Baldwin's, then desired Mr. Cound to undertake the management of their tinplate plant in Swansea and to lay down six new mills. On completion of the purchase of the British Forgings plant from the Imperial Munitions Board, Mr. Davies selected Mr. Cound to undertake the designing and laying down, and management of, their Canadian plant, which is going to mean so much to Toronto. What Baldwins are now undertaking in Toronto, and their plans for the future, is dealt with in an article elsewhere in this issue.

Mr. S. R. Cound

not only are the lives of the men engaged on the work sometimes at stake, but the safety of the public during the life of the building must also be safeguarded.

Under the laws of the state of Washington an architect from Canada cannot practice in any of the cities of that state, without first taking out citizenship papers or at least taking the necessary steps to become a citizen of the United States. On the other hand architects from the other side can practice in British Columbia without any question of citizenship or qualification being raised.

In both the engineering and architectural professions, the passage of the bills will bring iinto existence boards of examiners who will be qualified to deal with applications for certificates to practice and while the fact is recognized that it will be impossible to conduct examinations during the present year, the granting of certificates will be based upon the experience of the applicant, possession of certificates from elsewhere, and other facts which the examiners will take into consideration. In both bills sufficient time is set out for all practising in the province to apply for their necessary papers, but if, at the expiration of that time they have not done so, they will be unable to practice until they have obtained certificates by passing the examination.

Penalties for failing to observe the conditions laid down in the acts are provided for, as well as the right to suspend members for unprofessional conduct, negligence or other causes deemed unworthy of the callings.

As instancing the fact that in the submission of the bill local architects were not desirous of creating a condition that could be said in any way to cause inconvenience to those engaged in the profession or to the public, one of the provisions of the act stipulates that nothing in the act will apply to work on any building costing less than $5,000.

Have you any problems to solve in your business? Come and discuss them at the convention of the Provincial Builders' and Supply Association in Toronto, Feb. 10-11-12. The other fellow is up against them, too—he can help you and you can help him.

Large British Steel and Tin Plate Corporation Establishes Big Plant in Toronto

Baldwins, Ltd. of South Wales Take Over Plant of British Forgings, Ltd., on Ashbridge's Bay, Toronto, and Make Extensive Additions — Construction Methods are on an Unusually Large Scale

MESSRS. Baldwins Limited, of South Wales, are one of the largest, oldest and most progressive steel and tin plate corporations in the British Empire. To give an idea of the magnitude of their operations and of the amount of capital invested in their various enterprises, it may be interesting to state that this corporation, which is entirely British, operates fourteen steel plants, which employ between fourteen and fifteen thousand men in their various operations. A more concise idea of the tremendous scale upon which the concern operates can be formed by the following list of its annual output:

Yearly Output of Baldwin's Limited

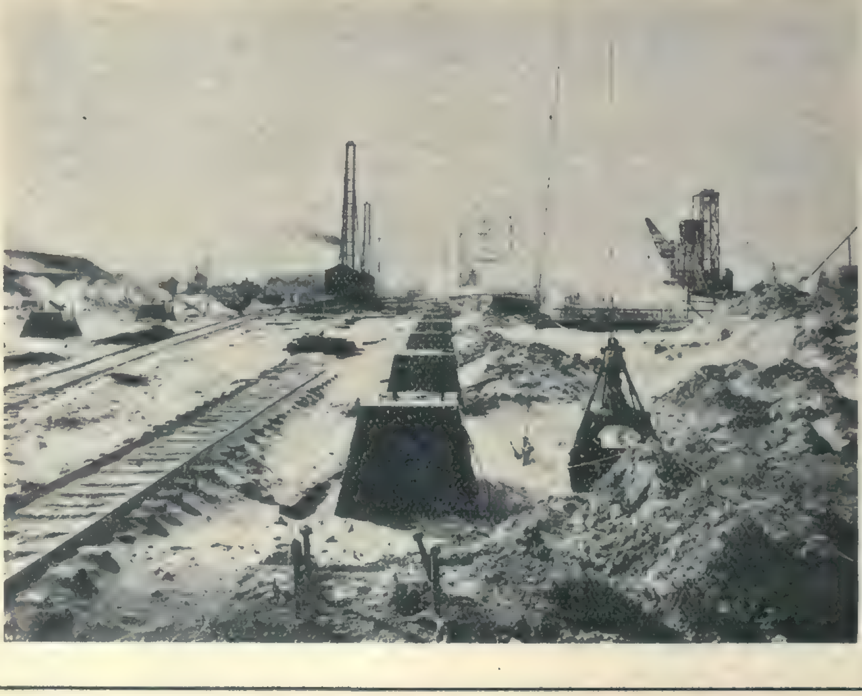
	Tons
Pig Iron	360,000
Steel Ingots	1,000,000
Manufactured goods, sheets, boiler plates, ship plates, rails, tools, sections, fabricated material	950,000
Galvanized sheets	75,000
Cisterns, tanks, miscellaneous materials from galvanized sheets	65,000
Tin plate, terne plate, lead-coated corrugated sheets	50,000
Iron sheets	20,000
Coal from Mines	1,250,000
Coke	300,000
Limestone	50,000
Silica Stone, and sand	20,000
Silica brick	7,000,000
Concrete brick	10,000,000

This corporation is not only interested in the manufacture of steel and iron, but owns and operates its own deposits of the material necessary for the various steel processes which are carried out. This makes the company practically independent of sources of raw material outside its own organization.

The plant and holdings of Baldwins Limited extend over the whole of South Wales and part of Monmouthshire and Worcestershire. The latest addition to their South Wales plant, which is now nearly finished, is one of the most complete of all the steel works in England. Ore and coal are delivered from their own mines to the plant and from this raw state go through all the various operations necessary to produce the finished product, including coke ovens, by-product plant, blast furnaces, smelting furnaces, rolling mills, etc. In addition to this plant a new site of from three to four hundred acres has been purchased, upon which it is proposed to lay down another complete and extensive plant. The whole of the extensive operations of this corporation are immediately under the charge of Mr. J. C. Davies, the managing director, who is one of the ablest steel and tin plate men in England.

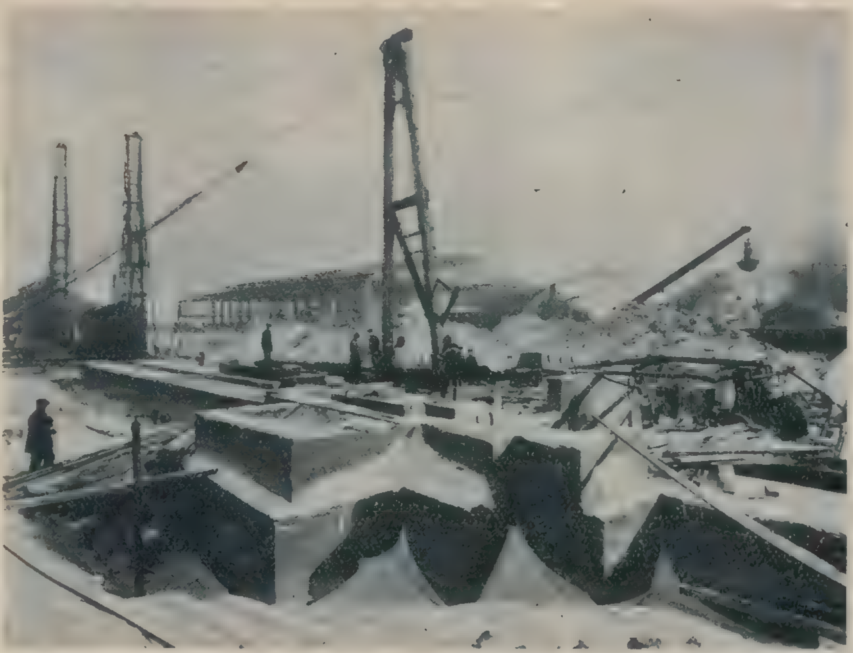
Entering the Canadian Field

This tremendous concern with its numerous ramifications, not wishing to limit its operations to England alone, and knowing the world's requirements in



General view of the foundation work, looking west, showing pile drivers on the second unit of the rolling mills; the cold roll foundation, and at the farthest end, the beginning of the steel work. Pedestals for the main building are shown in the foreground. There are 98 of these pedestals used in the foundations of the buildings.

General view of one end of the rolling mill foundation, showing pulling of steel pile cofferdam. Excavation for this foundation was 18 ft. wide by 230 ft. long by 19 ft. deep at the deepest portion, and was enclosed by heavy Lackawanna steel sheet piling on account of the instability of the soil. Concrete is carried on 480 timber piles. The wider portion of the foundation is for the driving wheel for the rolling mill. This wheel is 30 ft. in diameter and weighs 32 tons.



regard to steel and tin plate, is always seeking to extend its activities to other fields in the British Empire. Through the energy and foresight of Mr. R. Home Smith, of Toronto, and Mr. E. L. Cousins, manager and chief engineer of the Toronto Harbour Commission, Baldwins Limited were convinced, after the close of the war, of the large possibilities which lay in Canada for them, if they were to start operations in this country. Through the immediate efforts of the two above mentioned men, Mr. J. C. Davies of Baldwins Limited was induced to come to this country and inspect the plant of the British Forgings Limited, which was owned and operated by the Imperial Munitions Board, and which, until the armistice, was one of the largest and most successful electrical steel plants working on munitions on the continent. After a thorough inspection of this plant by Mr. Davies, it was decided by Baldwins Limited to take it over, and make extensive additions to enable them to supply the tin plate requirements of the country. The handling of the transfer of this plant from the Imperial Munitions Board to Baldwins Limited was conducted by Mr. R. Home Smith and Mr. E. L. Cousins.

To better identify itself with the country it was decided by the parent Company to incorporate its activities in Canada under a Dominion Charter. With this object in view a charter of the Dominion Government was issued under the name of Baldwins Canadian Steel Corporation Limited and by this name the activities of the concern will be conducted.

Extensions to Meet Tin Plate Requirements

The various basic processes which were used in the manufacture of munitions by the old British Forgings firm will be incorporated in the operations of the new company for the making of steel plate. To take care of the tin plate requirements of Canada, which amount to the very large total of two hundred thousand tons per annum, the new company is adding to the old plant by the construction of three main buildings, as well as various subsidiary buildings, one of the main buildings being 73 ft. in width by 800 ft. in length, and the other two being 70 ft. by 500 ft. and 48 ft. by 500 ft. respectively. These buildings will complete the processes on the billets that are poured in the electrical melting house and make them into tin plates. The initial capacity of the mills for tin plate will be approximately one hundred and fifty thousand tons of various kinds per year. The above composes the initial installation of the company which will probably be extended ultimately to two and a half times the present capacity.

Showing method of cofferdaming the excavation for the concrete pedestals, with timber sheet piling; and, in the rear, a portion of the excavation from the first rolling mill.

What a basic undertaking of this kind will mean to the city of Toronto and the Province of Ontario from a financial and labor standpoint will not be limited to the Baldwins plant alone as an individual

Detail of concrete forms for foundation of the cold rolls, showing the tunnels under the cold rolls and pipes for the anchor bolts. There will be some **200** bolts, 2¼ in. x 8½ ft., required to tie the rolls to the foundation, and the pipes, which are 5 in. in diameter, give sufficient play to insure that the bolts will fit in place. The tunnels are about 2 ft. wide by 5 ft. high and have openings on either side, 18 in. deep by 2 ft. wide by 2 ft. 6 in. long, under each pair of pipes, in which are the anchor plates, 2 ft. by 3 ft.

undertaking, but it means an increase in the demand from the allied industries which are necessarily bound up with it. It may be confidently expected that a number of new enterprises will spring up in Toronto and Ontario as a result of the location of Baldwins Limited in Toronto.

Manufacture of Tin Plate is Complicated Operation

The converting of the ore into billets and the final manufacture of tin sheets from the billets thus made is one of the most difficult and complicated processes of the steel industry, each department and operation presenting its own problem from a mechanical and technical standpoint. In the tin plate end of the industry especially, the securing of suitable manual labor is a most difficult task. It requires many years to produce what might be called a suitably educated class of men to carry on the tin plate industry. In South Wales this has been an hereditary business, and the son takes up and accumulates the knowledge of the father. Proficiency in the making of tin plate is the result of this hereditary knowledge gained by those who live in this environment. And the sons of Canada can now in this immediate neighborhood look forward to something which, in itself, will be an opportunity for further scope in craftsmanship.

It will therefore be seen that when such an industry is once established it becomes a basic and permanent business in the district in which it is located.

For the establishment and direction of this enterprise in Toronto, which in the opinion of Baldwins

Group of steel castings produced by the electric furnaces in the foundry. Largest casting weighs 12 tons. These castings are a portion of the rolling mill machinery to be used in the new plant. The foundry, in which steel for munitions was formerly turned out by the British Forgings, Ltd., contains six furnaces.

Limited will be one of their most important subsidiaries and which is anticipated to grow to outstanding proportions, the parent company have selected Mr. S. R. Cound, one of the ablest managers of their whole organization, who has special knowledge in the manufacture of sheets and tin plate. Mr. Cound has designed and laid out the whole of the new plant, and by his personal connection with the enterprise, it is expected to attain the greatest success possible.

Foundry Department

One of the important ends of this industry will be the foundry department, where steel castings of all kinds and sizes are to be made. The type of steel castings and quality of the work which will be turned out is shown in an accompanying illustration. Most of the castings shown in the illustration are castings that are to be used in connection with the company's rolling mills, on which they were unable to get delivery early enough for their purpose. These castings are being made with the double purpose of expediting the company's own work and as an example to the trade of the class of work they will be able to turn out. Already many orders are being placed with them for steel castings, as their capacity will be practically unlimited in this department of their business.

The energy and enterprise of the men behind this organization is shown in the vigor with which they have proceeded to carry out the necessary improvements to the old plant. Immediately the decision was reached to take over this site, the contracting firm of Roger Miller & Sons, Limited, was at once engaged to do the difficult rolling mill, furnace and other foundation work, necessary for the carrying out of the present development. This contract was given to the above firm in the latter part of September, and work was well under way on the first of October, and has been prosecuted with vigor continuously since that time. Although a very severe winter has been experienced, there has been no delay in the carrying out of the difficult and heavy foundation construction. The experience and organization of this firm well adapts them to carry out work of this character as they built a large portion of the old British Forgings plant during the war.

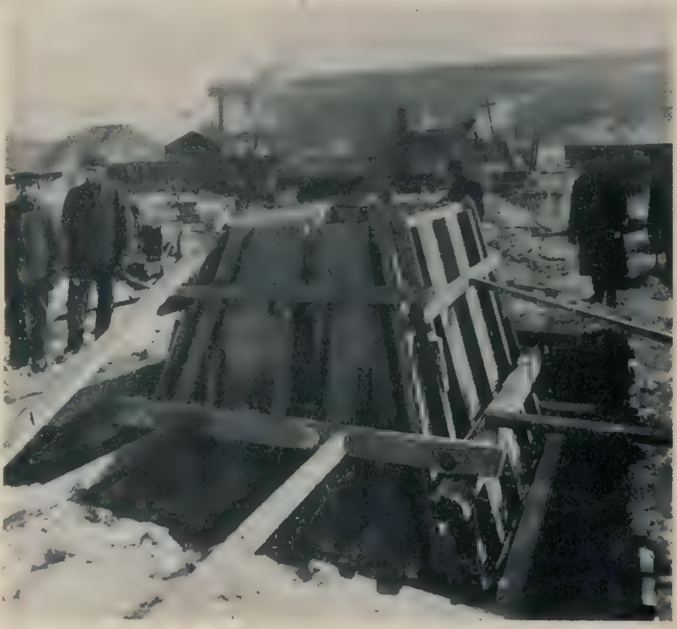
Foundations Carried on Piles in Soft Ground

Owing to the nature of the ground, which is of sand fill overlying the original marsh of Ashbridges Bay, all of the foundations have to be carried on piles, which are cut off approximately twelve inches below water level which at this point lies about five feet below the present ground level.

The first rolling mill foundation, which is now practically completed, and which contains some 2,300 cubic yards of concrete, is the deepest foundation of a heavy type yet put down in Ashbridge's Bay. The deepest part of this foundation is 19 feet below the present ground level and owing to the very unstable nature of the ground, it had to be enclosed in a steel sheet piling cofferdam. Before concrete could be poured, an interlocked mat of a double-thickness of two-inch planking had to be placed around the pile heads to hold the concrete; this was varied in the deeper portion of the excavation by placing rubble stone with a covering of crushed stone to give an even bearing. As will be seen from the illustrations all of the pedestals had to be sheet piled to permit excavating, as the ground was so unstable that it was impossible to get foundations excavated in any other manner.

Concreting in Cold Weather

Owing to the very scattered nature of the concrete for the rolling mills, furnaces, pedestals, etc., two portable concrete mixing plants were assembled on standard guage railway cars and railway tracks were laid parallel with the work. On account of the severity of the weather, steam pipe lines were installed to enable steam jets to be used in keeping the bottoms of the excavations warm; at the same time steam lines were run to the material cars, through which the steam was continuously passed during the mixing operations to keep the aggregate hot and enable the concrete to secure its initial set without injury. In connection with the pouring of the initial rolling mill foundation, the cold weather had already set in and steam pipe lines were laid through the tunnels in this foundation; a continual jet of steam was run through these and the anchor bolt holes during the pouring and supplementary heat was furnished by salamanders on the outside of the work. All of these larger foundations were poured from stationary plants with towers and chutes.



In foreground—detail of the form work of one of the concrete pedestals, which are 12 ft. in height. In rear—general view of one of the portable concrete mixing plants. The cars on either side of the mixer car, containing sand and gravel, have steam pipes running through them to keep the aggregate warm, and pouring of concrete has been successfully carried out in very cold weather.

Steel work for the buildings on this foundation is already being erected by the Canadian Allis-Chalmers Company and it is proposed by Baldwins to rush this work to completion, so as to get the plant in operation on the rolling of tin plate at the earliest possible moment. From the progress which is being made by the contractors this should be an accomplished fact early this year.

Plant Designed for Extension

To give an idea of the size of the initial additions to the plant, it might be interesting to note that some 54,000 lineal feet of timber piling have been already driven, and approximately 7800 cubic yards of concrete have been placed to date. The main buildings now under construction contain 117,500 square feet

(Concluded on page 116)

This illustration shows some of the forty-two houses erected in New Toronto by the local housing commission. They are of five and six-room detached and semi-detached styles, of solid brick or tile on concrete foundations

Systematized Methods Build New Toronto Houses at Low Cost

Solid Construction Residences of Four Types Erected at New Toronto, Ont.—Design, Fittings, Costs and Method of Disposal.

By E. M. Proctor, B.A Sc., A.M.E.I.C.*

IN 1918 the council of the town of New Toronto appointed the New Toronto Housing Commission as provided for under the Ontario Housing Act, and this commission made application for and obtained a loan of $200,000 from the Government. After canvassing the housing situation in the town, and receiving numerous applications for houses, it was decided to purchase a block of property on Eighth Street, and proceed with the construction of forty-two houses.

New Toronto is a suburb of the city of Toronto, located about six miles west of the city's western boundary, with the town of Mimico situated between. At New Toronto numerous large factories are located, including those of The Goodyear Tire and Rubber Company, The Dupont Fabrikoid Company; Brown's Brass & Copper Rolling Mills, Ritchie Ramsay Paper Company, Boxer Wall Paper Co. and others. Most of these factories have sprung up and developed since 1914. The bulk of the employees come out from the city to their work because it is impossible to secure a home in New Toronto. As an indication of the need for houses, it is only necessary to point out the fact that the forty-two houses were nearly all sold within a few weeks after the construction contracts were awarded.

Houses of Solid Construction

The types of houses decided upon were five and six-roomed houses, some semi-detached, and others detached. The type of construction, having in mind that the municipality would be primarily responsible for their maintenance and up-keep for 20 years, is solid brick or hollow tile with concrete foundation walls and cedar shingle roof—a first-class house in every respect.

It will not be out of place to give a short description of the procedure of purchase of a house under the Ontario Housing Act. Where the Housing Commission owns the land as in this case, the purchaser makes a deposit of 10 per cent. of the cost price and then pays the Commission, monthly, a sum sufficient to meet the interest and principal. The payments are based on 20 equal annual instalments with the interest figured at 5 per cent. It will readily be realized that the Commission is responsible for this investment for twenty years, and should a cheap type of house or one requiring considerable maintenance and repair be built, the Commission would be required to protect their investment by expending money for this maintenance. No allowance is made in the Housing Act for this contingency. It is for this reason that no type except the solid house was considered by the New Toronto authorities. The cost of the house to the owner is given below.

The houses have been built on the staggered plan and to avoid any monotony, the various types are scattered. The floor plans of the various types of houses are shown in the illustrations. Each house has a front vestibule and the rooms are designed according to the requirements of the Act. The six-room houses have front door with porch, side door and back door with porch; the five room houses have no back porch.

Construction and Fittings

As stated before, the houses are of solid construction, having concrete foundations with brick and stuccoed tile walls. The party wall in all cases is tile and the chimneys are solid brick. The interior walls have two-coat plaster, the first coat being hard wall plaster and the second, a white putty coat. The brick and tile walls are not strapped.

The rough timber is mostly hemlock with some B. C. fir. The finishing lumber, generally speaking, is Norway pine or B. C. fir. The doors, windows, frames and exterior trim are white pine. The ground

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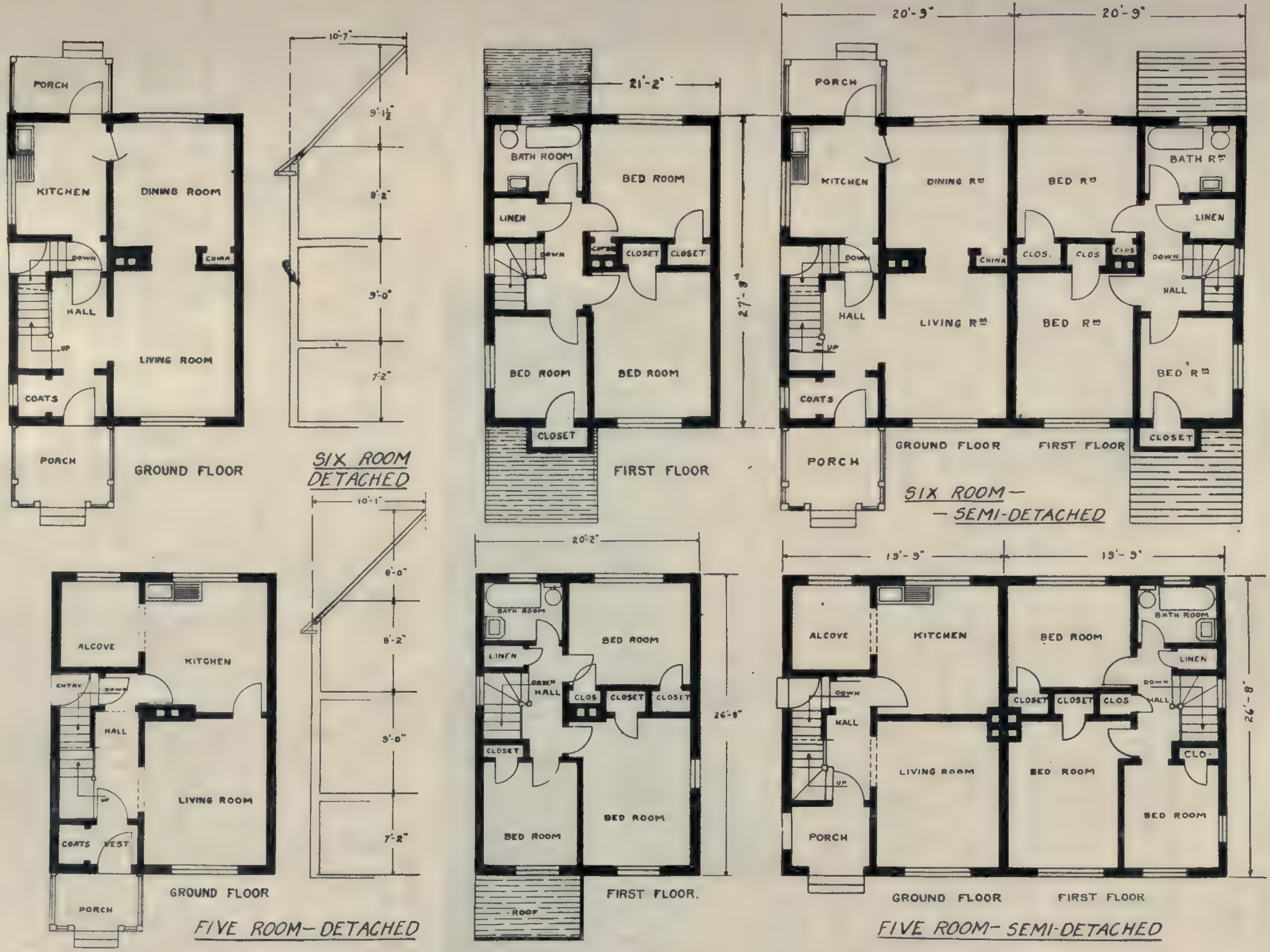
*Manager of the E. A. James Co., Ltd., Toronto.



The New Toronto houses are of four types, the floor plans of which are shown in this illustration. Rooms conform to the Ontario Housing Act standards floor is B. C. fir and the upper floor, No. 1 spruce. The verandah is finished with rough lumber.

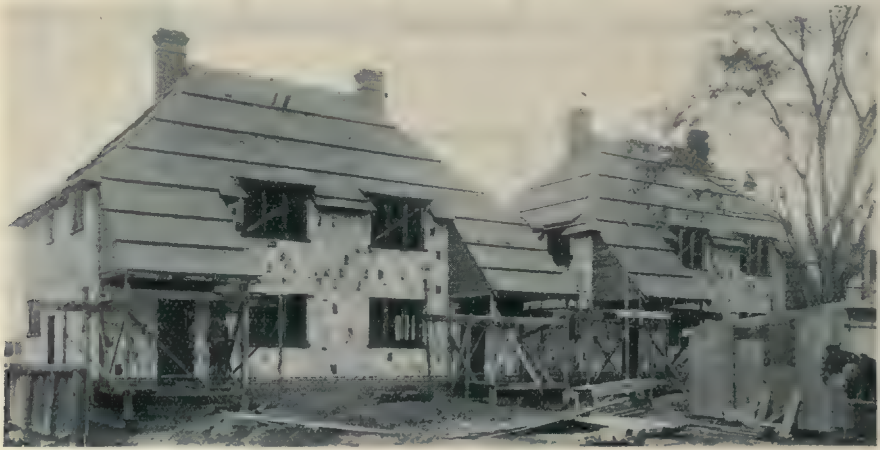
The specifications call for one coat of brown stain for exterior work, three coats of white paint for sash, three coats of white paint for trim of bathroom, bedrooms, hall, closets, etc., and stain and varnish for downstairs woodwork.

The plumbing consists of the following fixtures: P 6800 18 in. x 24 in. enamelled roll-rim kitchen sink; P 4335 wash basin; Essex 5 ft. roll-rim P 2610 bath; Vitro oak closet, with No. 1860 Mueller lever-action ball cock and Douglas flush valve and oak seat. All taps, nickle plated pipes, traps, etc., were supplied by the Mueller Mfg. Co., of Sarnia, Ont. The numbers above refer to the Standard Sanitary catalogue numbers.

The houses are heated by hot air, and a No. 1834 Pease hot air furnace is installed in each house. Metal registers and hot air ducts are provided. All rooms are wired for electricity with wall push button switches for control. The hardware was supplied by the Vokes Hardware Co. of Toronto and manufactured by the Toronto Lock Company.

Contract Prices

The contract for the plumbing, heating, wiring and sheet metal work was awarded to Mr. J. H. Doughty of Mimico for $455.00 per house. This price was made up as follows, the figures including material and labor.



The general type of construction is shown in this cut. These six-room, semi-detached solid construction houses cost $2,855 without land.

Plumbing	$250.00
Heating	130.00
Wiring	40.00
Sheet Metal Work	35.00
Total	$455.00

The general contract was awarded to Mr. Herbert Baxter of New Toronto, at the following prices, which include all grading, sidewalks into the houses, concrete basement walls, floors, brick work, carpenter work, painting, glazing and, in fact, all items not included in Mr. Doughty's contract. Below are given the contract prices for various houses and to each has been added $455.00, so that the total represents the complete cost of the finished house.

	General	Plumbing, etc.	Total.
Five room detached	$2475.00	$455.00	$2930.00
Five room semi-detached	2350.00	455.00	2805.00
Six room detached	2550.00	455.00	3005.00
Six room semi-detached	2400.00	455.00	2855.00

Built Ten Houses in Series

The method of construction has been to build about ten houses in series; that is, the basements for ten were excavated, then the concrete foundation walls were poured, the excavators having moved to the next ten. After the walls had set the bricklayers followed and then the carpenters, etc. It was endeavored to keep the crew on each trade up to sufficient strength so as to keep each trade well in advance of the next following operation. Unfortunately, on account of labor shortage this program was not rigidly followed although in a general way progress was maintained in that order.

The contractor had his own power saws and planing machines on the job, and all frames were constructed in his own shop. No unusual feature of construction was adopted, the contractor relying on ordinary house construction methods, but paying very close attention to purchase and consumption of materials.

From an inspection of the illustrations it will be readily appreciated that the houses are not only neat and attractive, but also substantial in construction. It is estimated that if another hundred were ready for sale it would take only a few days to dispose of them all.

How Houses are Sold

In the following table is given the cost to the purchaser, showing initial payment required, and also monthly payments, spread over 20 years, necessary to meet the interest and principal. The taxes and insurance amount to about $3.50 per month per house.

	House Alone	With Land, Architecture, etc.	First Payment	Monthly Payment
Five room detached	$2930.00	$3650.00	$365.00	$26.30
Five room semi-detached	2805.00	3525.00	352.50	25.30
Six room detached	3005.00	3725.00	372.50	26.80
Six room semi-detached	2855.00	3575.00	357.50	25.75

The houses were designed by and built under the supervision of the E. A. James Company, Limited, consulting engineers, Toronto, successors to James, Loudon & Hertzberg, Limited. The commissioners are: Mr. Chas. Lovejoy, chairman; Mr. Thos. Staunton, secretary, and Mr. Langstaff, all of New Toronto.

The Provincial Builders' and Supply Association convention in Toronto, Feb. 10-11-12, has for its object the increased prestige, increased prosperity and increased efficiency of the building industry. Do your bit.

Hydro-Electric Plant at Drummondville, P. Q.

7000 H. P. is Initial Development of Station on St. Francis River —Methods of Construction on Power House and Long Dam

THE new hydro-electric power development of the Southern Canada Power Company, at Drummondville, P. Q., is one of the chain of stations to be built at the various water power sites owned by the company at the St. Francis and adjacent rivers. This plant operates in parallel with the other plants of the company, and the power is put out on the company's transmission system which supplies Drummondville, Richmond, Sherbrooke, Granby, St. John's and St. Hyacinthe and the intermediate towns in that district.

This new Drummondville plant comprises, for the present, a 7,000 h.p. development with provision for expansion to an ultimate capacity of 18,000 h.p. A fall of 32 ft. in the St. Francis River is utilized, and to make this available a large dam was constructed to divert the flow of the river. The general arrangement of works is shown in the accompanying diagram, which illustrates the dam, forebay, power house and tail-race.

The dam, of concrete on a rock bearing, is 1890 ft. long, running diagonally across the river, diverting the flow to one side of the main channel and to the forebay. A stoplog section, 260 ft. long, consists of 9 piers, 6 ft. wide and 30 ft. long, with an abutment at the junction of the spillway at each end. The piers are at 26 ft. centres, thus providing ten clear openings, each of which is 20 ft. wide. Timber stop logs, bolted together in pairs and handled by an electrically driven lifting machine, regulate the flow. The apron of the spillway section is at the same elevation as the bed of the river, leaving a 19 ft. clear opening below the deck. The stop-log lifter operates on a track along the length of the deck.

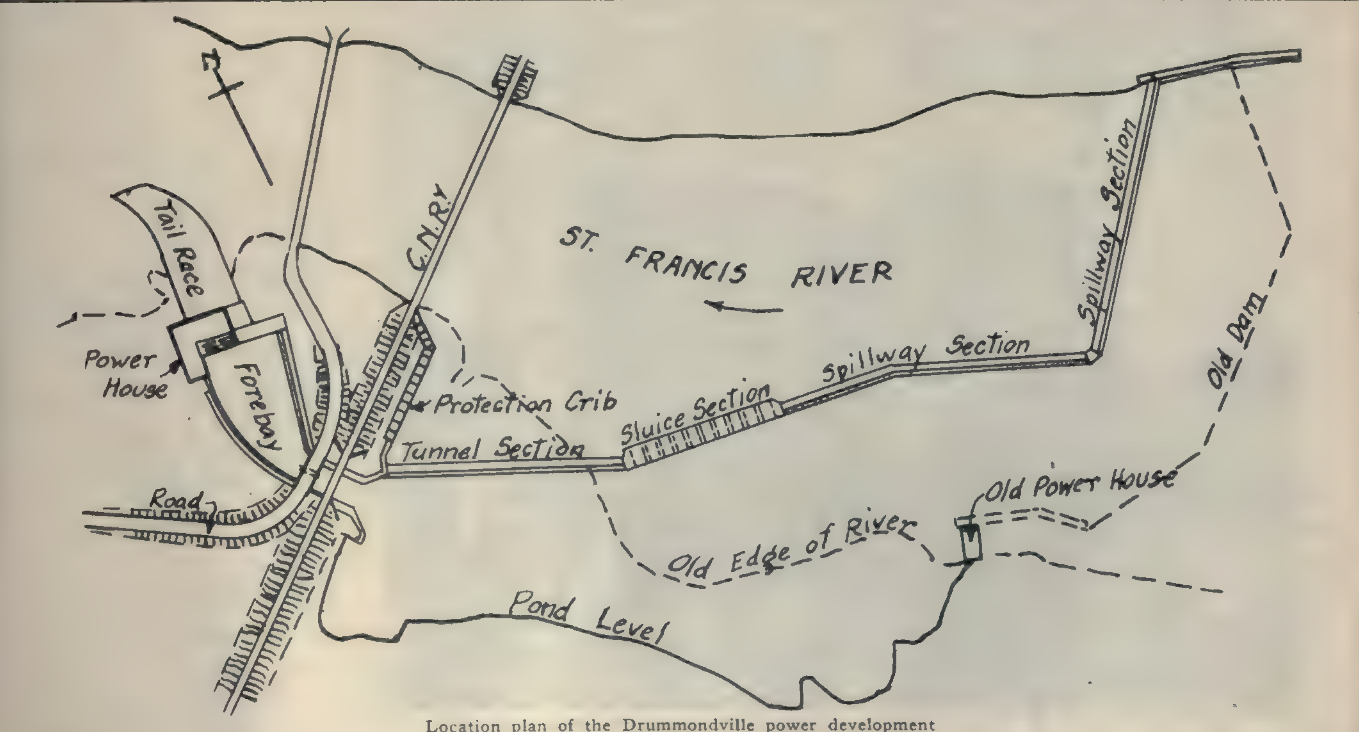
Spillway Section of Dam

The remaining 1630 ft. of the dam is an overflow section with a maximum height of 16 ft. The crest is 12 inches wide and the greatest width at the base is 19 ft. That portion of the spillway section from the forebay wall to the sluice section is built with a tunnel, 4 ft. wide and 7 ft. high, giving access to the deck of the sluice section, which is 6 ft. higher than the crest of the spillway. This portion, on account of the tunnel, is of wider section, and is also reinforced with steel.

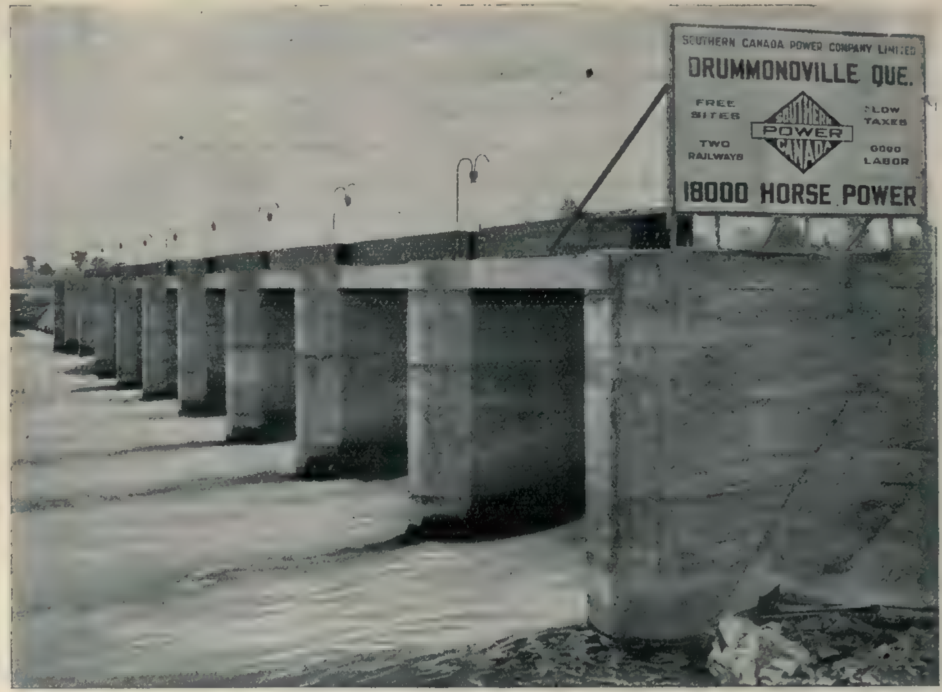
The forebay is enclosed with concrete walls. On one side the wall has a retaining wall section and averages 18 ft. in height, while that on the stream side of the forebay is a spillway section, 168 ft. long, with the crest 2 ft. higher than that of the main dam. This is to take care of abnormal flood water.

The Canadian National Railway, Montreal-Halifax line, croosses the forebay entrance by a two-span steel plate girder bridge supported on masonry abutments and a steel bent on pedestals. In order to protect the bridge foundations, the forebay enclosing wall on the east completely encloses this steel bent and pedestal and that on the west side is carried in front of the abutment. The walls are extended beyond the railway bridge so as to provide an abutment and pier for the new bridge which the railway company intends to erect at this point.

North of the railway, the canal was crossed by the public highway on a single arch concrete bridge at an



Location plan of the Drummondville power development



The stoplog section of the dam of the Drummondville power development comprises 10 sluiceways, each 20 ft. wide, which may be closed with stoplogs handled by an electrically-driven lifting machine operated along the deck of the sluiceway. Access to the deck is obtained through a tunnel in the adjoining spillway section of the dam.

elevation about 9 ft. below the top of the existing walls. This bridge was demolished and replaced by a two-span, reinforced concrete bridge 65 ft. long, with a roadway width of 24 ft. The floor is 9 ins. thick, supported by seven concrete beams 16 x 27 ins., sealed on the under side by a 4-in. slab in order to prevent any accumulation of debris during high water periods. The approaches to the bridge are earth with a top finish of broken stone, and are constructed to a grade of 1 in 20.

The power house and transformer house are under one roof. The former, including the generator room, is 71 x 66 ft. and, when completed to house the four units, will be 71 x 140 ft. The transformer house is 37 x 101 ft. The sub and superstructure walls, beams, columns, floors, roof and intake piers are all reinforced concrete construction. The intakes, scroll cases and draft tubes are formed in the mass concrete of the sub-structure and are heavily reinforced.

Superstructure walls are from 12 to 15 inches thick, stiffened by pilasters, placed between the windows inside and out. The roof is a 4-in. reinforced slab with

This illustration shows the power plant from the forebay with the transformer wing at the left. The building is constructed of concrete and it accommodates two generating units. The intake is extended, as shown on the right, to provide for gates controlling future generator installations.

8 x 10 in. concrete purlins supported on steel trusses.

The intake of the power house provides for four units, only two of which are at present installed. The head works for the uncompleted units consists of piers and deck constructed as far as the back of the future gates, and provide for the installation of stop logs. The gate for each intake is 12 by 26½ ft., constructed of steel and operated from the deck of the gate house by an electrically-driven worm gear.

2,700 Ft. of Cofferdam

The large amount of cofferdam work that had to be carried out was one of the chief features of the construction, which was somewhat complicated by the fact that the old power plant had to be kept in operation. Twenty-seven hundred feet of cofferdam was required, of which 1,900 ft. was for unwatering of the dam site, and 800 ft. for the tailrace excavation.

In addition, 1,000 ft. of cofferdam had to be rebuilt, when, on one occasion, during a heavy flood, the flow increased from 7,000 to 60,000 cu. ft. per sec., in 12 hours. About 75,000 lin. ft. of round timber was used in the construction of the cofferdams, all of which material was cut off the property of the company adjacent to the work.

The cofferdams were built in sections, the cribs being from 20 to 25 ft. in length. In constructing the cribs, the first few courses of timber were framed on a raft from which the crib was floated into position and loaded with rock. Additional courses of logs were added as the crib settled into place. To provide an even bearing for the sheet piling, the streamface timbers were dressed to true face and were all placed in the same vertical plane. Two-inch plank was used for sheeting.

Unwatering and Excavation Operations

In unwatering the site of the sluice section and part of the spillway the area was not completely enclosed with cofferdams, but a V-shaped enclosure was constructed with the crib on one side continued down stream for some distance to a point where the normal water elevation was lower than the bed of the river at the site of the foundations. This did away with the necessity of pumping out a large area, as the section shut off from the river drained completely with the exception of a slight seepage through the cofferdam which was conveyed away from the foundation excavation in ditches.

On completion of the concrete work within this cofferdam, water was allowed to pass through the stop-log openings and crib work, parallel to the site of the dam, was continued across the river. Floods caused such delay that a great deal of the cofferdam work had to be carried out in the winter season. This necessitated the removal of large quantities of ice before the cribs could be placed.

Considerable leakage developed in a portion of the cribbing owing to the rough bottom and the presence of fissures in the rock. To unwater the foundation effectively, a double row of sheeting, 2 ft. apart, was placed along the line of the upstream and downstream face of the masonry footing.

This view of the power plant from the discharge side shows the head works for the contemplated future addition to generating units. At present the power house contains two units developing 7,000 h.p.

The foundation excavation for the dam was through a heavy deposit of gravel and boulders overlying the stratum of very compact silt next to the rock. The maximum depth of excavation was 9 ft. The spoil was loaded into skips handled by a steam-operated derrick. The seepage into the excavation was pumped out by an electrically operated centrifugal pump.

Considerable excavation was required in front of the forebay. The material, sandy clay mixed with boulders, was removed in carts and scrapers. This material varied in depth from 3 to 6 ft. overlying very irregular ledge rock. The rock was levelled to a given elevation and a channel, 45 ft. wide and 6 ft. deep, was cut from the original shore line to the forebay canal.

Concrete Placing

There were two mixing plants, one serving the power house and forebay walls as far as the railway crossing; the other placed close to the end of the stop-log section of the dam. The plants comprised hoisting towers with two distributing hoppers on each, one at the top of the tower for distribution by chute, and the other at the foot for delivery into buggies. The aggregate bins were placed at the back of the mixing plants, and the material was delivered to the charging hopper above the mixer by chutes. Sand and gravel were brought in by rail to a stock pile from which they were transferred to the bins at the mixing plants by side-dump cars operated by cable from a hoist at each mixing plant. These cars were returned to the stock pile by gravity.

The concrete for the dam above the stop-log section was conveyed from the hoisting tower in side-dump cars operating on a track of 24-in. gauge, laid on a light trestle built along the up-stream side of the dam. The concrete was placed in sections. 30 to 50 ft. in length. To key the adjoining sections, keystone-shaped boxes, 12 in. deep, were placed in the bulkheads between the sections. The junction between the various sections acted as an expansion joint. In the tunnel section some of these opened up during the cold weather, but stoppage was provided by caulking the openings with oakum, followed by cedar strips.

The concrete for the mass work around the draft tubes and scroll cases was poured by chutes from the hoisting tower. All the remaining concrete was distri-

The transformer room is located in the basement of the power house. The equipment comprises three oil-filled water-cooled transformers stepping up from 2200 to 48,000 volts.

The switchboard and low tension bus structure are shown in this illustration. The switchboard consists of eleven panels located on a gallery overlooking the entire operating floor. Provision is made for control of future generators.

buted by buggies and cars. For mass work the mix was 1 : 3 : 5, and for walls, beams, columns and top finish of the dam, 1 : 2 : 4.

160 Yards of Concrete Placed per Day

On account of the uncertain weather conditions prevailing during the performance of the work on the last 800 ft. of the dam, and the possibility of further floods, a condition not unknown during the winter, every effort was made to expedite the work; and as a result, the unwatering, preparation of foundation and the placing of 3,300 cu. yds. of concrete were done in 46 days. Concrete was placed, on the average, at the rate of 160 cu. yds. a day, and the distance transported from the mixer to the forms was from 400 to 1,200 ft.

The major quantities involved in the construction were the removal of 21,000 cu. yds. of rock and 22,000 cu. yds. of other material in the preparation of the foundations of the dam and power house, also to provide suitable depth in the tail-race and forebay. Concrete quantities amount to 23,350 cu. yds., the bulk of which was reinforced, 370,000 lbs. of reinforcing steel being used for this work. Structural steel used for roof supports, racks and stop-log guides amounted to 170,000 lbs.

Electrical Equipment

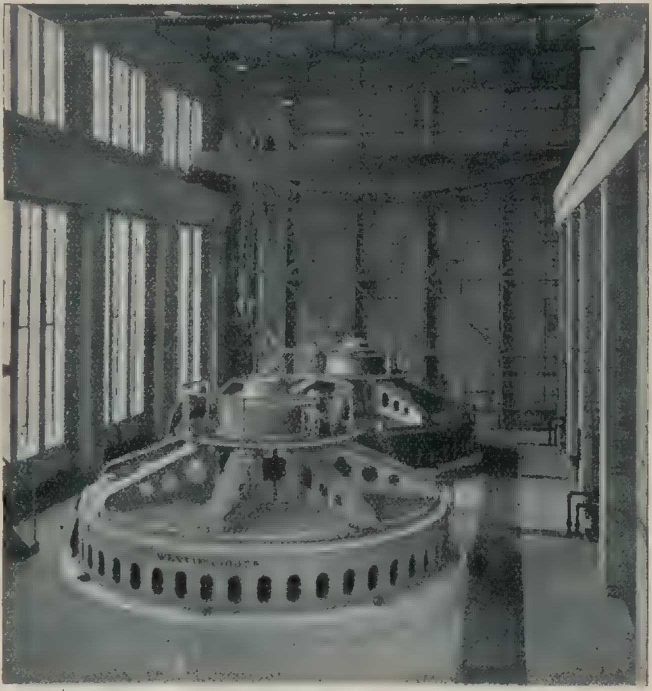
The equipment of the plant consists of two 3500 h.p. vertical shaft water wheels, manufactured by the Boving Hydraulic & Engineering Company, direct coupled to vertical shaft Westinghouse alternating current generators, three phase, 3,125 kv.a., 2300 volt, 60 cycle, 100 r.p.m. The wheels are governed by the latest pattern of Woodward oil pressure governor, 30,000 ft. lbs. capacity, and the plant operates very well in parallel with the other power stations of the company. The generators are fitted with an air brake, the pressure for which is kept up in a container by a motor-driven air pump, operated by an automatic air pressure switch. There are two exciter sets of 100 k.w. capacity, either of which is capable of providing excitation for the entire plant at present installed; together with contemplated extensions. Both exciters are arranged for use with volage regulators. One of these sets is driven by a water wheel manufactured by Boving Hydraulic & Engineering Company, and governed by a Woodward governor. The other exciter is driven by a 2,300 volt, 3 phase induction motor. These exciters are both fitted with equalizing switches and feed to exciter busses, from which the station emergency lighting and relay system are also operated.

The Switchboard

The switchboard is on a gallery overlooking the entire operating floor. It consists of eleven panels. The first panel is fitted with meters and switches for the control of the d.c. side of the two exciters. The second panel provides for the control of the a. c. side of the motor-driven excited set. The third panel provides for voltage regulators. The fourth and fifth panels control the two vertical shaft generators. The governors for each of the main units are also electrically controlled from the panels. The sixth and seventh panels provide for future generators. The eighth panel contains the totalizing instruments. The ninth panel controls the transformer tank, which feeds on to the out-going 48,000 v. line. This panel contains a switch for the electrical operation of the high tension oil circuit breaker. The tenth panel is for the control of a one to one transformer insulating the busses from the local feeders. The eleventh panel controls the station service and local feeder circuits. The oil switches are, with the exception of the station and local service circuits, all mounted below the gallery. Double bus operation is provided for throughout.

The transformer bank consists of three 1000 kv.a. oil filled, water cooled 2,200 to 48,000 volts, with taps. There is a spare transformer of the same size, and by means of the transformer disconnecting switch arrangement, any of these four transformers may be included in the bank with the minimum of delay. The oil pumps and water circulating pumps are electrically driven, and are all in duplicate. All of this auxiliary machinery is located in the basement.

Above the transformers, on a gallery, are placed the electrolytic lightning arresters, and the 48,000 volt oil and disconnecting switching, and choke coils. The high tension connections pass thence to the out-going line.



The power house contains two 3,500 h.p. units, as shown in this illustration of the generator room.. They are vertical shaft units, direct coupled to vertical shaft water wheels operating at 100 r.p.m. This plant operates in parallel with other power stations of the company.

The gate room is separated from the main operating room by a longitudinal wall, and forms a mezzanine floor. The main gates are electrically operated, by means of a motor with clutch and counter shafting. The racks are also located in this room, and between the racks and forebay there is a curtain wall, At one side of the forebay there is a trash gate.

A 60-ton overhead travelling crane operates over the generator room and across one end of the transformer house, and a similar crane of ten ton capacity handles the work in the gate house and that part of the building adjacent to the transformers.

This power development is in the middle of several other developments owned by the Southern Canada Power Company, which are larger, and one of which has considerable storage capacity. It is proposed to develop these, and operate them in conjunction with the plant herein described; thus furnishing an abundant and reliable supply of electric power to the prosperous territory covered by the transmission system.

Largest Attendance on Record at Annual Meeting of Engineering Institute

Business and Professional Convention at Montreal Reports Past Year's Activities — Engineering Topics Discussed in Papers

THE Annual and Professional Meeting of the Engineering Institute of Canada was held on January 27-29, in Montreal. The attendance was the largest on record, 413 members registering on the first day. The meetings were to be held in the Institute Headquarters, Mansfield Street, but owing to the large attendance it was found necessary to remove to the Windsor Hotel. Colonel R. W. Leonard occupied the chair.

Reports from the different branches occupied the morning session of the first day, Jan. 27th. All of the reports were submitted, with the exception of the Winnipeg branch. The Toronto Branch report was exceptionally good. Twenty meetings were held in Toronto during the year. Five of these were for the purpose of discussing that important question, "Legislation for Engineers." Three new branches have been established in Ontario: the Niagara Peninsula Branch at Niagara Falls, the Border Cities Branch at Windsor, and the Peterborough Branch. The Kingston Branch has recently renewed its activities after temporary suspension during the war.

Letters were read from several members regretting their inability to attend. Chief among these were communications from Mr. E. W. Beatty, president of the Canadian Pacific Railway, and Mr. Howard Kelly, President of the Grand Trunk Railway.

After the reading of the Branch reports, a discussion on the financial statement was held. Plans were submitted whereby the members could overcome the six thousand dollar deficit which they now face, but it was decided to leave the matter over till a later date.

An Enjoyable Complimentary Luncheon

About four hundred members and their lady friends attended the luncheon given by the members of the Montreal Branch on the 27th. They were formally welcomed by Colonel Leonard, the retiring president, and Commissioner R. A. Ross, the president-elect. An address on "Modern Highway Problems" was given by Mr. E. W. James, Assistant Chief Engineer, Bureau of Public Roads, Washington, D.C., who dealt first with the administrative side of the question, and finally with the technical problems which face the Federal and State governments of the United States. He stated that twenty-seven years ago no state highway departments existed. This year there were forty-eight. Three years ago, he continued, the Federal Government took over and continued the process of development of highways. Six hundred and thirty-three million dollars had been set aside for road construction in the United States during the present year. On the technical problems faced by the highway engineer, Mr. James dealt first with the question of impact. He stated that tests were being made in the United States regarding this question. He also referred to the experiments being made on bases of all kinds. He stated that where roads used to be built by the mile, they were now built by the square yard. In closing, he advised the young engineers to go into the matter of highway construction.

Election of Officers

At the afternoon session, on Jan. 27th, slight changes were made in the by-laws and recommendations of council. It was decided to divide Ontario into three districts instead of two, as it is at present. This will raise the number of electoral districts to ten instead of nine. Following are the officers for the ensuing year:

President—Mr. R. A. Ross.

Vice President—Brig. Gen. C. H. Mitchell.

Councillors—Messrs. F. B. Brown, J. C. Smith, A. R. Decary, F. A. Bowman, J. B. Challies, E. R. Gray, G. C. Dunn, B. S. McKenzie, G. W. Craig, J. R. C. Macredie and H. W. Burwell.

The question regarding where the next annual meeting would be held, was discussed. It was finally decided to leave this matter to the council. Mr. J. B. Challies opened an interesting discussion regarding legislation of engineers. He read a bill which had been advanced by a group of engineers in Toronto, in which they advised registration for each group of engineers, instead of all engineers together. Colonel Leonard, in his valedictory address, spoke of the work done by the engineers in the war, also of those engineers who had laid down their lives. He spoke of the political unrest now prevailing in Canada, which, he said, was exactly the same as that which had started Russia on the downward path. He spoke of the necessity of buying "Made in Canada" machinery, and in closing stated the necessity of co-operation between the engineers and labor.

Mr. R. A. Ross, the new president, was called to take the chair. He referred to the work done by the members during the year, especially by Colonel Leonard, the retiring president.

About four hundred members and friends attended the dance given by the Montreal Branch in the evening. They were welcomed by Mr. R. A. Ross, the president.

Wednesday Morning's Session

"The Gateway of the Profession" was the chief topic of the morning meeting on January 28th. This was exceptionally well brought out in two addresses, one on "The Training of the Chemical Engineer," by R. F. Ruttan, M.A., M.D., Sc. D., F.R.S., Professor of Chemistry and Director of Chemical Laboratories, McGill University, and the other on "The Importance of Physics in Engineering," by A. S. Eve, D. Sc., C.B.E., F.R.S., MacDonald Professor of Physics, McGill University. Dr. Ruttan described the methods of training the chemical engineer used in McGill. He spoke of the shortness of the engineer's course, stating that one year should be added to the four years' course. Dr. A. S. Eve, in his address, stated that the art of engineering is really the application of physics. He took as an example the Quebec bridge. In regard to the training of an architect, he said, the teaching of physics was absolutely fundamental. Dr. Eve said that, in the recent war, the men who had had a scientific training were really the ones who had made good. The next point touched upon was the importance of early training for the boys of our Dominion, and that, in his opinion, a general education at sixteen or seventeen is the best than can be obtained. Dr. Eve spoke of the necessity of having trained men, so that we should not be dependent on the United States for expert advice. He paid a tribute to the men of the universities who had returned from the war and resumed their studies under great difficulties. In closing. Dr. Eve spoke of the necessity of close relation between the engineer and physicist.

Technical Education

A discussion on technical education followed these addresses. Brigadier-General C. H. Mitchell, Dean of the Faculty of Applied Science and Engineering of the University of Toronto, emphasized the points brought out in Dr. Ruttan's address. The necessity of engineers employing their brains in Canada and for Canada, was, in his opinion, one of the greatest thoughts of to-day. General Mitchell stated that a university of to-day should not follow the policy of "wait and see," but should look ahead and be ready when the time comes, to say: "we have educated these men and they are ready for you." He spoke of the necessity of the student combining his course with the engineering industry, because a student's education lies out in the industries of life. In referring to the question of a fifth year being added to the engineering courses at the universities, Gen. Mitchell said that, in his opinion, the elementary work should be taught in the last year at school, instead of the first year at college, as it is at present. In closing, he spoke of how glad he was to be back after six years' absence from the Institute.

Doctor F. Adams, of McGill University, in emphasizing Gen. Mitchell's remarks, spoke of the difficulties instructors of engineers had placed in their path. He said it was quite possible for the schools to carry on the first year work of the university. In a four-year course, he said, there were only two and a half years of actual study. In his closing remarks, he stated that within the next two years a fifth year will have to be added to the course.

The last speaker, Professor C. F. Scott of Yale University, gave an outline of work carried on in the training of an engineer at Yale.

Luncheon at Northern Electric Company, Limited

A luncheon, as guests of the President and the Directors of the Northern Electric Company, Limited, was given to the members of the Institute immediately after the morning session on January 28th. This was followed by an inspection of the works.

The annual banquet of the Institute was held on Wednesday evening, January 28th, President R. A. Ross occupying the chair. Lieut.-Col. R. W. Leonard proposed the toast, "The Engineering Profession," which was responded to by Professor C. F. Scott. The Hon. Charles Marcil, Brig.-Gen. C. H. Mitchell, and Dr. F. D. Adams were among the speakers.

Quebec's Water Power Resources

The meeting of the Institute was continued on Thursday morning, January 29th. The first speaker was Mr. O. Lefebvre, Chief Engineer of the Quebec Streams Commission, who read a paper on "Quebec's Water Power Policy and the Work of the Quebec Streams Commission." Mr. Lefebvre placed Quebec's rivers in two classes: those that are navigable and floatable, and those that are unnavigable and not floatable. By the term navigable he meant a stream that could be used for transportation purposes. The speaker gave an outline of the power development in the Province of Quebec. At first power development was considered an experiment and was backed by private individuals, but now the Provincial Government was either leasing power rights or selling them outright. During the last ten years a number of power rights had been leased, some of these for periods up to sixty-three years. In Mr. Lefebvre's opinion power development should be encouraged in order that more of Quebec's five million available horse power may be utilized. In his closing remarks, Mr. Lefebvre described the work of the Commission.

Mr. T. J. Lafreniere, chief sanitary engineer of the province of Quebec, whose subject was "The Operation of the Quebec Public Health Act," gave an outline of the work done in the province. According to Mr. Lafreniere there were 440 waterworks in the province, 192 of which were very small. Eighty-six per cent. of the population of Quebec is supplied with river water, four per cent. with lake water, and the remaining ten per cent. with spring water.

Quebec Highways

The last speaker at the morning session on January 29th was Mr. Alexander Fraser, assistant engineer in the Department of Roads for the Province of Quebec, who gave an address on "Quebec Highways." Mr. Fraser described the different road acts which had been passed as far back as the 17th century. He emphasized the necessity for good roads in the rural districts of the province, a policy which was recognized by the provincial government when in 1911 they started a campaign to interest the people of Quebec in good roads. A year was spent in this campaign, and it proved very successful The provincial government set aside $1,500,000 for good roads between 1908 and 1919. Between 1910-1919, $250,000 of this amount had been used for gravel roads. Mr. Fraser went on to say that there were forty thousand miles of roads controlled by the Province outside of the amount under municipal control. In closing, Mr. Fraser gave an outline of the work of the Department of Roads. The Province of Quebec is divided into three districts, with an engineer in charge of each. They are responsible to the Chief Engineer of the Department of Roads.

Twelve Millions a Year

A discussion dealing with these subjects followed. Mr. W. A. McLean, Deputy Minister of Highways for the Province of Ontario in his remarks on the roads of Ontario stated that twelve million dollars would be spent annually for the next five years for good roads in the Province of Ontario. It was also the intention of the Ontario Government to build a highway extending from the Quebec boundary line to Windsor.

Mr. Willis Chipman, discussing the address "The Operation of the Quebec Public Health Act," spoke of the necessity of having an engineer on the Ontario Board of Health. Mr. J. B. Challies, Superintendent of the Water Power Branch, Department of the Interior, Ottawa, paid a tribute to the work done by the Quebec Streams Commission.

At the afternoon session Colonel O. M. Biggar spoke on "The Policy of the Canadian Air Board."

Bonus System Applicable to Construction

Contractors Can Successfully Employ Time and Bonus Method as Already Applied to Most Lines of Business

By W. C. Nisbet*

THOROUGH testing of the value of bonus systems on construction work within the next few years seems very probable, as results secured in other industries by this means become more widely known. In the comparatively few instances to date where a successful plan of paying bonuses to laborers and foremen on outdoor work has been evolved, the basis of the system has usually been the standard time and bonus method of wage payment.

This plan is based upon the establishment of a standard time for the performance of a certain amount of work, and when this set task has been accomplished, the payment of a substantial bonus for additional work done. In this way the workman is assured of a fair wage every day even should conditions be unfavorable for a large output, and then at other times he is enabled to earn higher wages than would otherwise be possible.

Since the work done by a gang of men is the result of joint effort, the performance per cent. for the entire gang is the factor that determines the bonus to each man. Further, the bonus percentage for the gang is the bonus percentage for the foreman, and is applied to his salary for the pay period, thereby furnishing him with an effective incentive to secure rapid and efficient work.

This method of payment for services, namely, a fixed hourly wage plus an additional percentage which increases as the output of individual or gang reaches or approaches some predetermined standard, was originated by Harrington Emerson in 1905 during his work for the Atchison, Topeka & Santa Fe Railroad, and was at first applied to machine shop operations. It was designed, however, for universal industrial use, and was rapidly extended upon this railroad to cover the several thousand operations in the maintenance of equipment department, a few of which were turning a rod on a lathe, pressing wheels on to an axle, repairing frame of a locomotive, removing ashes from an ashpit, making a certain number of entries on cards (clerical), making a drawing of specified size and kind (drafting).

This list will give a conception of the variety of operations which this wage system was readily made to cover even in the early years of its use. In each instance the principle was exactly the same. First, a standard time was set as being a reasonable time in which to do a certain job once. At the end of the pay period the number of times the job had been done times the above standard time, would be entered and compared with the actual time put in. If the standard had been attained a bonus of 20 per cent. in addition to regular wages would be paid. If something less than standard had been attained, a smaller bonus percentage would be paid, down to a point where but two-thirds of the standard was attained. Then the bonus percentage reached zero, but the regularly hourly rate was, of course, invariably paid.

The theory of this wage system is that the payment of the regular hourly rate of the trade or craft for the locality is necessary to attract the worker and to bring him on the job, and the bonus is to reward him for doing a good day's work—for exercising fully his physical and mental powers.

It was originally intended, and this is actually carried out in practice, to have a careful analysis of each operation made at the time the standard time is set, and the best way of doing the work decided upon and set down in writing. This is practised more or less completely as conditions allow. It becomes a guide for the foreman, and often becomes of great value for another reason, namely: It places in the hands of the management a complete explanation of best methods used, rather than allowing these to remain in the heads of foremen or superintendents, who may leave at any time.

The saving of time, due to following the best method over that required to follow the worst method, or even the common method, is generally even a greater saving than that attained by getting the men to work industriously, which, although very desirable, is distinctly a different affair.

Since 1907, when this wage system had become completely installed in the Santa Fe maintenance of equipment department, and up to the present, the method has been widely extended and developed. Mr. Emerson did not attempt to retain control of the new methods, but made them public for the use of all, and published his list of bonus percentages for corresponding efficiencies, with a complete description of the whole system.

A partial list of the industries in which this bonus system has been applied may be of interest: Aluminum manufacture, automobiles, cotton goods, cloaks and suits, candies, drug manufacture, farm implements, foundries, flooring, insulating materials, lumbering, machine shops, mining, municipal work, men's garments, publishing, paper mills, packing houses, quarries, railroads, rubber goods, silk threads and fabrics, structural steel, sash and door plants.

Same System Will Apply to Most Operations

Inasmuch as this paper is for general contractors, some one may before this have raised the objection, "Contracting is different, and what might apply to these other industries will not apply to our business." Many manufacturers have raised the same point, saying: "That scheme may be all right for a machine shop, but not for my plant." The answer is that it will apply to most operations in most lines of business.

Frankly speaking, the writer does not know of any instance where the standard time and bonus system has been applied to contracting as a business, but he is perfectly familiar with many instances which have a resemblance to contracting where it was successfully applied. A few of these will be given and the list made as diversified as possible.

Hand Excavation on Railroad Cut

(1) Digging a short ditch through a railroad cut, with trains in operation. Hand work loading into small dump cars, hauled out by boy and mule.

Those in charge decided on the method and a number of men who could work to advantage, then set the time standard, which was, let us say, 5 men for 13 days, or 65 man days. Then suppose the job actually took 70 man days—the efficiency attained was 65 divided by 70, or 93 per cent. This would pay a bonus to all hands, including foreman and mule driver, of 13 per cent. on their wages, as reference to the second table below will show.

---

*Of the Emerson Engineers, New York. A statement prepared for the Committee on Methods of the Associated General Contractors.

	Rate per day	Time	Wages	Bonus	Total
Foreman. . . .	$5.00	14 days	$70.00	$9.10	$79.10
Laborer	4.00	14 days	56.00	7.28	63.28
Boy	3.00	14 days	42.00	5.46	47.46

If one laborer at $4 per day laid off ½ day, his earnings would then be $4 times 12½ days, or $50 in wages, with a bonus of $6.50, or a total of $56.50.

The bonus percentages for various efficiencies are as follows:

Efficiency Per cent.	Bonus Per cent.	Efficiency Per cent.	Bonus Per cent.
75	1.0	90	10
76	1.6	91	11
77	2.0	92	12
78	2.4	93	13
79	2.8	94	14
80	3.3	95	15
81	3.8	96	16
82	4.3	97	17
83	5.0	98	18
84	5.5	99	19
85	6.0	100	20
86	7.0	101	21
87	7.6	102	22
88	8.4	103	23
89	9.2	105	25

Surfacing New Railroad Track

(2) Ballast and surface a piece of new railroad trcak: Suppose the grade is finished, ties placed, rails spiked and bolted and ballast dumped on the track. Gang of 14 men with a foreman comes on the job to raise and to surface to grade stakes. The standard is, let us say, .055 man hours per foot of track. At the end of a two-week period, when wages are computed, suppose the gang has actually put in 1,950 hours (15 men times 10 hours per day times 13 days), and that they have raised and completely surfaced 7 miles of track or 36,960 feet. The standard hours to be compared to the 1,950 actual hours are then 36,960 feet times .055 man hours per foot, or 2,031 standard hours; 2,031 divided by 1,950 gives an efficiency per cent. of 104 per cent. This pays a bonus of 24 per cent. on the wages of each individual in the gang for the pay period in question.

In this case some one may ask how is it possible to determine whether the workmanship is acceptable. Some one must pass upon the acceptability of all work done, whether on bonus or otherwise. We have standards of quality, whether written in specifications and drawn on tracings or simply implied and enforced by inspection. The laborers and gang have to be impressed that the work must be done according to the usual standards of quality. In rare instances trackmen have had to be impressed with this by causing them to lose their bonus or requiring that they do the work over without a bonus.

Carpenters on Bridge Work

(3) Foreman and 12 bridge carpenters assigned to build new deck and install deck on new bridge. Air compressor and pneumatic equipment for boring and tapping furnished.

To illustrate the method of computing wages, suppose that the foreman got $7 per day, that 13 bridge carpenters got $6 per day each, that one man received $5 per day to dress tools, etc., and that one man received $4 per day to tend the air compressor. Assume a standard of .2 day's time for each foot of finished bridge deck and that at the end of a pay period of 13 working days they had completed 905 feet.

The actual days of labor were, say, 16 x 13, or 208; the standard days of labor were 905 ft. x .2, or 181; the efficiency was 87 per cent. (standard 181 divided by actual 208), which pays a bonus of 8 per cent. on wages.

	Wages	Bonus	Total
Foreman.	$91.00	$7.28	$98.28
Bridge carpenter	52.00	4.16	84.24
Man to dress tools	65.00	5.20	70.20
Man to tend compressor	52.00	4.16	56.16

Construct Concrete Arch Bridge

(4) Build a small concrete arch bridge for new line of railroad. (a) Dig foundations.

Suppose, on examination, here a standard is set of .25 of a man day per yard of excavation. If six men and a foreman completed the job in 8 working days with a yardage of 230 yards, the computation for bonus payment would be as follows:

Seven men for 8 days, equals 56 actual days and 230 yards times .25 man days per yard equals 57.5 standard days. This gives an efficiency per cent. of 103 (standard 57.5 divided by actual 56), which in turn entitles all hands to a bonus on their wages earned during the period, of 23 per cent. Now, in practice this bonus per cent. and the bonus in dollars is not computed for each job separately, but rather by day periods, and to illustrate how different jobs are combined, we will suppose the gang mentioned above spends the remainder of the time in the pay period in unloading and storing sacked cement.

(b) Unload and store sacked cement. Suppose six men and foreman (same gang as above) worked four days and unloaded, trucked and stored 8 cars of cement, for which a standard had been set of 3 man days per car. Their actual time is 7 men for 4 days, equals 28 man days and the standard is 8 cars times 3 man days per car, or 24 man days. If the 84 days covered constituted a two-week pay period, the wage and bonus earnings would be something like this:

	Standard days	Actual days	Efficiency (Per cent.)
Job No. 1..	57.5	56	..
Job No. 2..	24	28	..
	———	—	—
Total	81.5	84	97

Bonus per cent. for efficiency of 97 per cent. is 17 per cent. of wages; therefore the wages and bonus would be as follows:

	Bonus	Total
Foreman, $5 per day for 12 days, or $60..	$10.20	$70.20
6 men, each $4 per day for 12 days, or $48..	8.16	56.16

(c) Build forms (carpenters). Suppose carpenters now go to work on the forms.

To illustrate such a condition we will assume that the job was started at the beginning of a pay period, and at the end of the period was not yet completed, but that 2,000 square feet had been put in place, that the number of men engaged was four plus a foreman, and that the standard was .025 days per square foot. The actual man days were then 5 men for 12 days, or 60, and the standard was 2,000 square feet times .025 man days per square foot, or 50 man days. The efficiency on the job then was the standard of 50 divided by the actual 60, or 83 per cent.

It is most desirable to have the standards cover individuals only where this can be done, separating the operations into parts. Although this makes more clerical work it is certain to stimulate the workmen to do their best. The next best plan is to have the standards separated so as to cover the work of small groups. If any drones are in the gang the others will raise a noise and ask to have them replaced if a bonus is involved.

It is not advisable to set standards covering the work of over thirty men in a gang. When more than that are included in one efficiency standard, the effect is lessened. In such cases it becomes something like a profit-sharing plan where all workers share alike in the annual profits. The possibilities in profit-sharing plans are too distant, too vague and not directly tied in with the work of any one individual, hence their effect is not very great.

Some suggested units of productions are as follows: In excavation, cubic yards removed; in railway construction, feet of track or number of ties of rails laid; in masonry, cubic yards in place; in building construction, if concrete, feet of floor laid; if steel, tons or lineal feet in place; if wood, square or cubic feet in place.

It is understood that this method entails more clerical work than is needed where straight hourly wages are paid. However, as by its means a reduction of 15 to 25 per cent. in labor cost is often attained, the extra cost of the clerical and other supervision is well expended. Contractors should bear in mind that this has been proved to be an excellent means of increasing output per workman in many industries, and that at a time such as the present when greater production is essential to prosperity, every effort should be made to conduct their operations more efficiently.

Good Roads Congress, Feb. 9-13

IT is well known that the war conditions were a great handicap to road construction, and maintenance was reduced to the barest necessities. The result is that roads all over the country, even those of the most approved construction are sadly in need of repairs. While new construction and adequate maintenance almost stopped, traffic, especially motor traffic, took great strides forward, with resulting damage to the highways. These subjects and many others pertinent, will be discussed at the convention which will be held in connection with the Tenth Annual Good Roads Congress, and the Eleventh Annual Good Roads Show, at Louisville, Ky., February 9 to 13, inclusive.

The official call for the convention has been issued, and the program is in the course of preparation. A very instructive, as well as entertaining feature will be the exhibits of road machinery and road materials. Every kind and class of appliance and device for labor saving and producing better results will be on exhibition at the show, where officials, engineers and contractors may become familiar with their mechanism and operation.

Favor Sixteen-Storey Hotel

The members of the Chambre de Commerce, Montreal, at a recent meeting declared themselves in favor of the erection of the sixteen-storey hotel, on Dominion Square.

Large British Steel and Tin Plate Corporation Establishes Big Plant in Toronto

(Concluded from page 103)

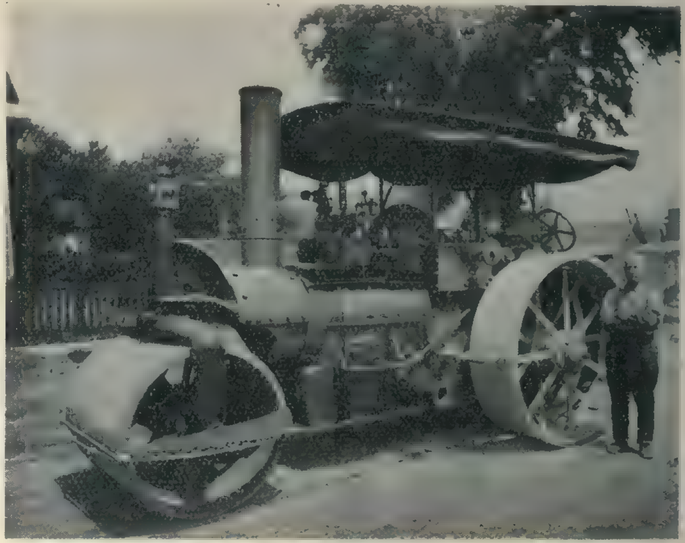
of floor space and represent a total length of 1800 feet, all of which space will be closely taken up with equipment and operating space for the manufacturing of tin plate. The whole plant is so designed and laid out that the ultimate proposed capacity will be attained by the lengthening of the buildings, now being constructed, and duplicating the equipment.

The buildings have been laid out so that the floors will be on a level with the railway cars standing on the sidings, thus eliminating unnecessary lifting and lowering of material. This necessitates a very large quantity of filling to carry the floor level to the desired elevation.

The firm of Hngh Russell and Sons, Limited, of Montreal, the representatives for a number of years of Baldwins Limited, in this country, have been appointed the sales agents for the whole out-put of this plant. They have opened offices in the Royal Bank Building Toronto, for the purpose of taking care of this end of the business.

Road Roller Gives 22 Years' Service with Few Repairs

The illustration herewith is of unusual interest in that it shows a road roller that has been in constant use for 22 years with a practically negligible repair expense. The machine is a Buffalo Pitts roller and is owned by the corporation of St. Catharines, Ont. It was purchased, as stated, 22 years ago and in writing about its service, W. P. Near, city engineer of St. Catharines, states: "The roller has never been sent to a repair shop, a few wearing parts have been replaced and two or three patches on the boiler plates have been made but the total repairs since its purchase would not aggregate more than $200. The roller has proven an excellent machine and it has been well taken care of by a competent steam engineer, Mr. E. Flummerfelt, who has been in charge of the machine since its purchase. The roller is working nearly every day." This roller was manufactured by the Waterous Engine Works Co. of Brantford, Ont.



This roller has served St. Catharines, Ont., for 22 years, with less than $200 repairs

Hints for the Contractor

That May Save Him Time and Money—We Will Pay for All Accepted Items—Send One In

Close Regulation Makes Winter Concreting Safe

WORKMEN schooled in the methods followed and trained to leave nothing to chance make concrete construction in cold weather entirely safe. With the functioning of the human element thus assured, the mechanical equipment needed and the methods employed are so simple that they are within the means of any building contractor. They are the only means employed by the construction company with which the writer is connected, and it has never been compelled to stop work because of winter conditions.

An example of winter concreting procedure is furnished by the three-storey concrete building, 156 x 66 ft., under construction at Rockford, Ill., the methods of which are described in Engineering News Record by G. A. Stockhus. In preparing to concrete a floor of this building, care is first taken to stock-pile all the aggregate required so that the heating apparatus may have from 24 to 36-hr. action on the material before any is used. There must be absolute certainty that no frosted material gets into the mixer, and long heating is necessary to give this assurance.

On this operation the steam boiler is large enough to run four steam lines into the sand and gravel and also a 1-in. service line to the floor to be concreted. This line is branched off into lines laid along the center of each bay and the full length of the building. These branch lines have connections for steam hose. With the hose, column and beam forms are steamed out just ahead of the pouring until there is no possibility of accumulated ice or snow remaining. The corrugated dome forms in particular are steamed carefully, as ice forms easily in the corrugations and, being transparent, is easily overlooked. It is the sole task of one man to do the steaming, keeping just ahead of the pouring operations.

Steam-operated mixers are, for safety, employed in all winter work. They are less liable to be shut down by winter conditions. The heated materials are mixed with boiling water so that the concrete virtually begins to set as soon as it is deposited. As fast as the slab is poured it is covered with a thin tarred paper on which is spread about 6 in. of wild slew hay. This slew hay holds the heat much better than tame hay or straw. Within 48 hours after the floor is poured and protected as described, the column forms for the next floor can be erected. As each storey is ready it is closed in tightly by canvas side curtains Great care is taken in placing these curtains to close every opening by which air enters. Salamanders keep the inclosed space warm.

The practice employed embodies no new methods or appliances, except in the one respect that every procedure is carefully watched and no single thing is left to chance. On this care, and in the training of the workmen, rests the success of winter concrete-building construction.

Handling Heavy Track Material By Machinery

IN a paper on the above subject before the Roadmasters' and Maintenance of Way Association convention in Chicago, Mr. J. B. Baker of the Pennsylvania R. R., gave numerous illustrations of the rapid and economical handling of track material with power devices.

Heavy rails are unloaded from cars with an air-operated derrick and boom with rail hook, the air being obtained from the train line. With this arrangement a crew of 6 men is found to be ordinarily efficient.

Ties, frogs and switches, when distributed by a work train, may be handled by a rail loader, including a hook which will unload from an open car and release in mid air. For unloading ties in storage yards, power-operated davits set in the car stake pockets and fitted with hooks and chains have been found to be economical. The use of a trolley hoist on a light I-beam is suggested for unloading from box cars, one end of the I-beam being clamped to the roof, the other end extending through the doorway of the car and supported by an A-frame on the ground outside. An overhead lifting device suited to the nature and volume of the work is necessary in the handling of frogs and switches in and out of cars.

Rail-laying machines are considered economical where it is possible to have the use of the track for several hours at a time. A small hand-operated rail layer consisting of a carriage and boom tracking on the opposite rail from that being installed, and lifting the rail by hand winches has been found to be an excellent device. With some of the heaviest rail this small machine with 5 men did the work of 20 men using ordinary rail tongs. When the old rail is thrown out the new rail may be set in by the machine at the rate of about a rail per minute, and while this is usually no faster than when done by a competent gang of men with tongs, fewer men are needed with easier work for the men. With this operation it has been found economical to apply a pair of splices to the far end of each rail, held together by only one bolt loosely applied.

Railway men are coming to realize more and more the possibility of effecting economies with power devices, partly on account of the insufficient supply and high cost of labor, but quite as much on account of the increasing weights of parts of railway track which require considerable handling.

Make the coming annual meeting of the Provincial Builders' and Supply Association, in Toronto, the biggest convention of Ontario men that any industry has ever held!

Mainly Constructional

East and West—From Coast to Coast

The Housing Commission of Peterboro, Ont., will visit three or four cities throughout the Province to see what has been done by other commissions in the way of housing development.

Mr. George Anderson, the California irrigation expert, who was engaged by the Alberta Government to make a survey of the northern Lethbridge irrigation project, has submitted his report, which shows that an expenditure of $5,000,000 would be required to carry out this scheme.

A deputation of citizens from Kingston, Ont., interviewed the Dominion Government recently with reference to harbor improvements. Matters are progressing well in connection with the improvement scheme and it is hoped that the necessary appropriation will be made by Parliament at its forthcoming session.

According to a report from Regina, a valuable deposit of white fire brick clay has been located in the southern part of the province of Saskatchewan. The clay, it is stated, is almost free from iron and could be readily manufactured into fire brick, hollow tile, white glazed tile, and even some grades of porcelain.

Reports from the county councils of Ontario, received at the Department of Highways, show an expenditure of $5,085,000 during 1919 on county roads systems. The Province's share of this expenditure is $2,337,000, which is based on a 40 per cent. grant on county roads and a 60 per cent. grant on Provincial county roads.

A large deputation which waited upon the Ontario Government, recently, were promised the Government's support to a movement for the establishment of a million dollar grain elevator at the foot of Cherry St., Toronto A million dollars was provided in the Dominion Government's estimates last year for this purpose but was struck out by Parliament.

At the municipal elections held recently at Victoria, B.C., a by-law calling for the expenditure of $420,000 as the city's share of the construction cost of a bridge across the harbor, was passed by a big majority. In addition to the above amount, the Provincial Government is contributing $200,000 and the C.P.R. $100,000, the total cost of this undertaking being $720,000.

London, Ont., building returns for the past year show almost a 200 per cent. increase in value over 1918. The comparative figures are: 1919, number of permits, 1186, value, $2,455,170; 1918, number of permits, 774, value, $876,660. In the month of December there were 38 permits issued, at a value of $431,200, as compared with 19 at a value of $27,980 in the same month of 1918.

J. M. Wilson, of Toronto, engineer in charge of the Hamilton Harbor development, and E. L. Cousins, chief engineer and manager of the Toronto Harbor Commission, lectured recently before a gathering of several hundred Hamilton citizens interested in the city's harbor development. Many large maps and drawings, showing the development of the Toronto waterfront, were on display, and Mr. Cousin's lecture was illustrated with several interesting lantern slides depicting the progress made in harbor developments at Toronto since 1912.

The Faculty of Applied Science and Engineering, University of Toronto, secured the services of Mr. Thomas Adams, Dominion Town Planning Advisor, for the recent inauguration of the new town planning course in the University. Mr. Adams delivered a number of lectures on the subject of town planning. This course which is designed chiefly for the senior members in civil engineering, mining engineering, and architecture, is the commencement of a new course or series of courses, embracing the broad principles of civics generally, town planning, landscape architecture, etc.

Contract for the new Wood-Vallance warehouse, to be erected at the corner of Eighth Ave. and Hamilton Street, Regina, was let recently to the Poole Construction Company. The new building will be 100 x 250 ft., three storeys and basement, and will be of brick construction with cut stone trimmings. In the preparations of the plans special attention has been given to fire protection; the stairs will be inclosed within fire walls, automatic doors will be provided for the purpose of isolating any outbreak of fire, floors will be of fireproof construction throughout, and a modern type sprinkler system will be installed. Cost of the warehouse will be $250,000.

The Greater Winnipeg Water Board has completed arrangements for the establishment of the largest building material handling plant in western Canada. At a meeting held recently they awarded the contract for the construction of gravel bins to Clayton Bros., of Winnipeg, purchased a Worthington rock crusher from the Dominion Equipment and Supply Co., and are preparing for the purchase of a fleet of motor trucks and trailers, capable of handling up to 1,000 cubic yards of material daily. The municipal gravel pits have a total daily capacity, under the best working conditions, of 1,000 cubic yards a day. The board is going into this matter extensively, and, when ready for operation, will have a full equipment, including their own steam shovels, gravel train and dump cars, screens and stock bins, trucks and trailers, for the rapid and economical handling of aggregate and road material.

It is expected that construction work will be commenced on Ottawa's new 21-room public school about May 1. The new school, which will be situated on York Street, between Friel and Chapel streets, will be of rustic brick construction trimmed with terra cotta. In the basement which will be of reinforced concrete, will be situated the domestic science room, manual training room, clay modelling room and boys' and girls' play rooms. The ground floor will contain nine class rooms and a 40 x 60 ft. gymnasium, which will be equipped with a stage, so that it can be used as an assembly hall. There will be ten class rooms on the first floor. The buildings, which will accommodate 765 pupils, will be equipped with blower system of ventilation, shower baths and lockers in the basement, lavatories on every floor, and will be heated by steam. Ottawa's school building program, planned to date, entails an expediture in the neighborhood of $800,000.

Personal

Mr. H. W. Calkins, manager of the Toronto Builders' Supply Co., Toronto, was presented with a handsome reading lamp recently by the employees of the firm, on the occasion of his moving into a new residence which he has built. Mr. George Swansborough made the presentation on behalf of the employees.

Mr. S. E. Craig, B.A. Sc., has been been appointed 2nd vice-president and district manager of the Montreal office of the Candian Inspection and Testing Company, in place of Mr. T. S. Griffiths. Mr. Craig graduated from the University of Toronto in 1904, with honors, and was engaged with various engineering corporations until 1912, when he joined the Canadian Inspection & Testing Laboratories, Limited. He has had a wide experience in engineering work.

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New Constitution of A.C.B.C.I. Will Meet Industry's Requirements

THE constitution of the Association of Canadian Building and Construction Industries underwent considerable alterations at the convention at Ottawa last week, and, we, believe, in its new form will meet the requirements of so comprehensive an organization in a country of Canada's size and scattered population. It will, there is little doubt, receive the approval and support of general contractors, sub-contractors and supply men alike throughout the Dominion, because it is simple, flexible and easily applied, and promises not to be too burdensome, financially. "Why, yes, that's the logical thing to do!" was the remark with which the plan of organization was generally received. While the constitution and by-laws have not been worked out in all their final details, the main features are as follows: The affairs of the association shall be managed by a National Council consisting of five officers, elected at the annual general meeting, together with three representatives from each province, to be elected by the various provincial associations. Where there is no provincial organization the local exchanges will still have the privilege of electing these three representatives to the National Council. The local exchanges will become collective members of the A.C.B.C.I. One membership will be secured by the payment of $25, which carries with it one vote at the annual meeting. As many memberships as desired may be purchased, entitling members to a corresponding number of votes. Individual membership is also provided for, as it was believed it would not be possible to finance the Association satisfactorily with fees from local organizations. Individuals or firms engaged in any branch of the construction industry, may become direct members of the A.C.B.C.I. by the payment of the $25 fee which entitles them to one membership. Any firm may purchase as many memberships as it desires, and it is expected that the larger concerns will in this way contribute very materially to the financial success of the organization. Provincial bodies, being made up of collective members, automatically receive one membership in the A.C.B.C.I. They may purchase further memberships if they desire.

It will be seen that there is no intention whatever on the part of the A.C.B.C.I. to make any impositions or restrictions on existing organizations. It merely seeks to unify, and therein lies its hope of success.

General Contractors' Section of Montreal Builders' Exchange

A SPECIAL meeting of the general contractors section of the Montreal Builders' Exchange, was held on January 22nd. It was moved by Mr. A. W. Ross, seconded by Mr. Douglas Bremner, and agreed that the following be nominated for Board of Directors of the Exchange for the current year: Messrs. K. D. Church, (chairman), W. C. Munn, J. P. Anglin, John Quinlan and C. M. Morssen.

Mr. J. D. Johnston of the Canada Cement Company Limited, gave a short talk on the delivery of cement. It was agreed that except for use on large jobs, delivery in bags was most suitable.

A letter from Mr. J. P. Anglin, stating that "it has been the habit of some engineers and architects to require certified cheques when calling for tenders," was submitted. It was declared that this habit was open to grave objections and should be discouraged. On the motion of Mr. J. P. Anglin, seconded by Mr. A. W. Ross, it was resolved that the members of the section should refuse to give certified cheques for private work as required by some architects and engineers, and approved of the stand taken in this connection by Anglin-Norcross, Limited.

The agreement between the United Brotherhood of Carpenters and Joiners and the general contractors' section was discussed, and it was moved by Mr. Douglas Bremner, seconded by Mr. John Allan, and agreed that the following committee be appointed to meet and select three to be empowered to carry out the terms of the agreement: Messrs. Munn, (Convener) Cape, Anglin, Morssen, Shearer, Allan, Hand, Bremner, Hudson, Robertson, Evely and Quinlan, Mr. K. D. Church, was appointed an ex-officio member of the committee.

Canadian General Contractors' Association Formed

DURING the Conference of the Association of Canadian Building and Construction Industries at Ottawa, last week, the General Contractors held two meetings to discuss matters of particular interest to their section. The men present were strongly impressed with the benefits of the A.C.B.C.I. and believed that the construction industries could, in union, bring about results that they could not achieve separately. They also felt, however, that the general contractors had certain interests peculiar to themselves which made it wise for them to get together as a distinct body. It was therefore decided to organize the Canadian General Contractors' Association. Mr. W. H. Yates' motion, as amended by Mr. Thomas, of Calgary, provided that: "We, here assembled, organize ourselves as a Canadian General Contractors' Association consisting of members of local organizations throughout the Dominion, and apply for a membership in the Association of Canadian Building and Construction Industries." Mr. J. B. Carswell, of Toronto, was elected Chairman of the Association, Mr. W. H. Yates, vice-chairman, and Mr. Graham, secretary.

The attitude of the general contractors toward the A.C.B.C.I. was expressed in resolutions endorsing the main organization and expressing their readiness to adopt a code of ethics that would attract the subcontractors and material men.

Topics of Prime Interest to be Discussed by American Concrete Institute

THE convention of the American Concrete Institute will be held on February 16, 17 and 18, at the Auditorium Hotel, Chicago, overlapping, in joint sessions, on the second and third days the National Conference on Concrete House Construction. During the same week, conventions of the American Concrete Pipe Association and Concrete Products Association are being held. The Institute program, while containing a varied list of reports and papers, will concentrate attention on a few major topics of big interest.

The Committee on Contractors Plant will present a report which should be of unusual interest in these times of greatly increased wages to workmen and of frequent difficulty in obtaining materials. Every bit of slack in the contractor's organization must be taken up and his forces used most effectively, with the best mechanical equipment and the best utilization of that equipment, in order that he may have control of his costs. The design and construction of the contractor's plant is a real live problem and is likely to continue to be in the immediate future.

A special Committee on Standardizing the Specifications for Steel Bars for Concrete Reinforcement is at work upon the idea that in these times when prompt mill shipments of steel are not to be obtained and when a large percentage of steel bars must come from local stock, it is of prime importance that steel specifications be so standardized as to simplify the problem in steel bar supply. It is proposed, if possible, to make one specification or perhaps two specifications to simplify steel bar stock. Closely allied with this problem is that which arises from a multiplicity of steel bar sizes. It is proposed to bring about a reduction in their number.

Further in the matter of economy is the work of the Committee on Standardization of Units of Design for a saving in cost that can frequently be made in the construction of reinforced concrete buildings by limiting the number of sizes and types of beams, girders and columns, etc. Where such a saving may have to be made at some waste of steel or concrete it is proposed to encourage designing engineers to balance the saving which may be effected in the erection cost against the cost of additional materials which may be required in simplifying the design. In short, to show the way that lies somewhere between the design which is theoretically correct and the design which will be the most economical to follow in the actual construction.

Another special Committee on the Determination of Proper Unit Values for Vertical Shear in Reinforced Concrete Design has already prepared a report which is being submitted to the Institute membership so that it may be adopted at the convention. Many engineers hold the opinion that the value of 150 lbs. per sq. in. is too conservative a figure and that a higher stress could be used with safety and with considerable saving in the cost of foundations for buildings.

A special committee is working on one of the unsolved problems in concrete construction arising from the question of relative merits of different types of concrete floor finish as now in use in building construction:

(a) Monolithic finish.

(b) Two inch or three inch concrete base with monolithic finish.

(c) One inch finish laid some weeks subsequent to the structural concrete.

(d) Finish of one part of cement to one part sand sifted onto freshly screeded concrete surface and troweled hard with and without the addition of an iron hardener.

(e) Improvement in construction of finish, if any, due to the addition of quick stone or liquid, wherein silicate of soda predominates.

A number of other committees are actively engaged in the work for which they were appointed and will present reports and recommendations at the coming convention. Among these are committees on research, building blocks and cement, concrete roads and pavements, aggregates, concrete chimneys, concrete sewers, houses, and storage tanks.

The W.C.K. City

Westinghouse, Church, Kerr & Co., Inc., engineers and constructors, of New York and Montreal have issued a folder entitled the W-C-K City, showing a composite photograph of all the work designed and constructed by this organization. The value of the enterprises making up the W-C-K city is over $130,000,000. Every piece of work has been conducted entirely on the basis of cost plus a fee and fifty per cent. of the jobs are repeat orders. No works are illustrated unless they were designed and constructed in their entirety by Westinghouse, Church, Kerr & Co.

No. 10

Canada's Engineers—Alan Mair Jackson

New Zealand was the birth place of Major Alan Mair Jackson, who, on returning to Canada in April last after three years' military service, was appointed county engineer of Brant County, Ont. Following Mr. Jackson's graduation from Otaga University, New Zealand, he served as an apprentice for six years in a foundry and machine shop, chiefly on the erection of machinery and then became assistant engineer on drainage and sewerage in the city of Dunedin. Following this he served for six months as supernumerary engineer on a cargo tramp steamer, but left this position upon the arrival of the steamer in England. For the next four years Mr. Jackson was connected with the gold mining industry of South America, having left England in 1905 to erect a gold dredge in British Guiana and to run a survey of a large gold dredging concession in the jungle. Subsequently, he joined the Barima Gold Mining Co. in Demerara on the border of Venezuela. While in the employ of this company he erected all their machinery and built several miles of light railway. In 1909 Major Jackson returned to England, going to Canada early in 1910. After a year in the mechanical department of the Canada Foundry Company, he started an engineering practice in Dunnville, Ont. He passed the O. L. S. examinations and became engineer for Haldimand County in 1912 and in 1913 he purchased the surveying and consulting practice of Howard Fairchild of Brantford, Ont. In March, 1916, he enlisted in the 215th battalion as captain, subsequently receiving the rank of major. He went to France with the 257th Railway Construction battalion, after reverting to a captaincy. In France he was again promoted to the rank of major and was in command of 'A" Company of the 7th battalion Canadian Railway Troops for twenty-two months. On his return from active service in April last year he was appointed county engineer of Brant County, Ont.

Major A. M. Jackson

U. of T. Engineering Alumni Form Association

In connection with the Annual and Professional meeting of the Engineering Institute of Canada held January 27 to 29, at Montreal, the engineering alumni of Toronto University held a meeting on January 29th, when it was decided to form an association. A general re-union of the alumni association will be held at Toronto next October. Among the speakers were Brig.-General C. H. Mitchell, Commissioner R. A. Ross, and Mr. G. Herrick Duggan. The following officers were elected: President, Mr. W. J. Francis, Montreal; vice-president, Dr. T. K. Thomson, New York; council, Messrs. J. M. Robertson, J. B. Challies, E. R. Gray, J. L. Morris, G R. Munro, W. J. Chase and W. A. Buck.

Victoria, B.C., to Build $720,000 Bridge

The construction of the Johnson Street bridge in Victoria, B. C., has now been authorized, and it is the intention of the city to carry out the work as soon as possible. Application will be made forthwith to the Dominion Government and the Railway Department, and it is expected that tenders will be called some time in May. According to F. M. Preston, city engineer of Victoria, the estimated cost of the completed work is $720,000, of which $100,000 will be contributed by the Esquimalt & Nanaimo Railway, and $200,000 by the Provincial Government. The approximate weight of steel in the superstructure is 2,800,000 pounds, and there will be approximately 10,000 cubic yards of concrete in the piers and abutments. A single leaf bascule with one 120 foot channel is provided for. The approach spans will each be approximately 120 feet in length.

Mr. Preston also states that nothing further has been done with regard to the Rock Bay bridge at Victoria.

$60,000,000 for Ontario Roads

Hon. F. C. Biggs, Minister of Public Works and Highways, has secured $6,000,000 as Ontario's share of the Federal Government's "Good Roads" appropriation. This, with six millions from the Province of Ontario and three millions from the municipalities, will provide a fund of $15,000,000 to be spent on the main highways of the Province during the next five years. In addition to that amount, 45 millions will be expended by the municipalities individually, aided in various ways by the Provincial Government. The total estimated expenditure on the roads of Ontario during the next five years will therefore amount to $60,000,000. An important feature of the new Minister's policy is assistance to township roads to the extent of 20 per cent. Mr. Biggs had a conference with the Dominion Good Roads Commission last week, and the general outline of his plan received full approval.

Building permits granted by the City of Montreal for the month of January, totalled $227,655 as against $60,154 for the same month last year.

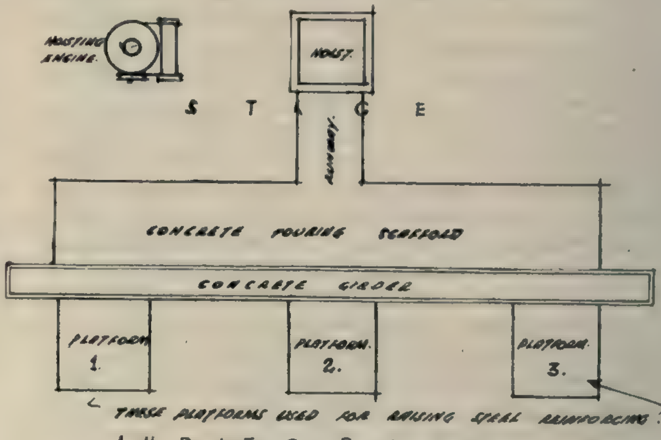
Constructing a Massive Proscenium Girder in Toronto's Largest Theatre

One of the Biggest Girders Ever Poured in Toronto Measures 51 ft. in Span, by 13 ft. Deep, by 2 ft. 2 in. wide — Difficulty in Forming and Shoring

By F. E. Brown*

THE new Pantages theatre now being erected in Toronto, Ont., on Victoria Street with the entrance on Yonge Street, has over the proscenium opening one of the largest concrete girders ever poured in Toronto. This girder has a clear span of 51 ft., is 13 ft deep and 2 ft. 2 in. wide with a wall bearing at each end of 6 ft. 10. in. The mix used was 1:2:4 stone concrete and the reinforcement consisted of eighteen 1½ in. round bars with ¾ in. stirrups at 12 in. centres. The pouring was continuous and took 14 laborers and 2 engineers 12 hours to complete. The pouring took place in December, during cold weather, and to protect the concrete from frost, two 1 in. steam lines were run from end to end, one being placed 3 ft. from the bottom of the girder and the other approximately 8 ft. These pipes were placed in the centre of the concrete and were cut off after the concrete had set and were left in the girder.

The big difficulty was the forming and shoring of the girder as it was 28 ft. 0 in. above the stage wall with no walls nearby to brace to. There was approximately 93 tons to carry besides an allowance necessary for vibration, etc. Some idea of the amount of labor and material required for the erection of this form work, may be obtained by the drawings and photographs here illustrated. The uprights were made of two pieces of 2 in. by 10 in. spiked together; the intermediate cross braces were 2 in. by 10 in. at 6 ft. centres with 1 in. by 6 in. diagonal braces The top ledgers were 36 ft. long made from two pieces of 2 in. by 10 in. with joints broken. The braces carrying the projecting ends were also 2 in. by 10 in The form sides were made of ⅞in. by 6 in. matched and dressed on 2 in. by 4 in. uprights with two rows of ½ in. bolts in the height and two rows of braces on each side. The nearest wall to tie to was 37 ft. away and for this purpose ¼ in. cables were used with turnbuckles. When the forms were removed, it was found that the girder was only 9/16 of an inch out of line and there was still a camber of 1¼ in. left of the original 1½ in. given it.



Steel for girder was raised on three platforms and concrete was poured from buggies supplied by hoist

Owing to the intricate nature of the shoring in the immediate vicinity of the girder, the steel reinforcing comprising long and heavy bars was handled in the clear space of the auditorium and hoisted onto three platforms from which the rods were set in place.

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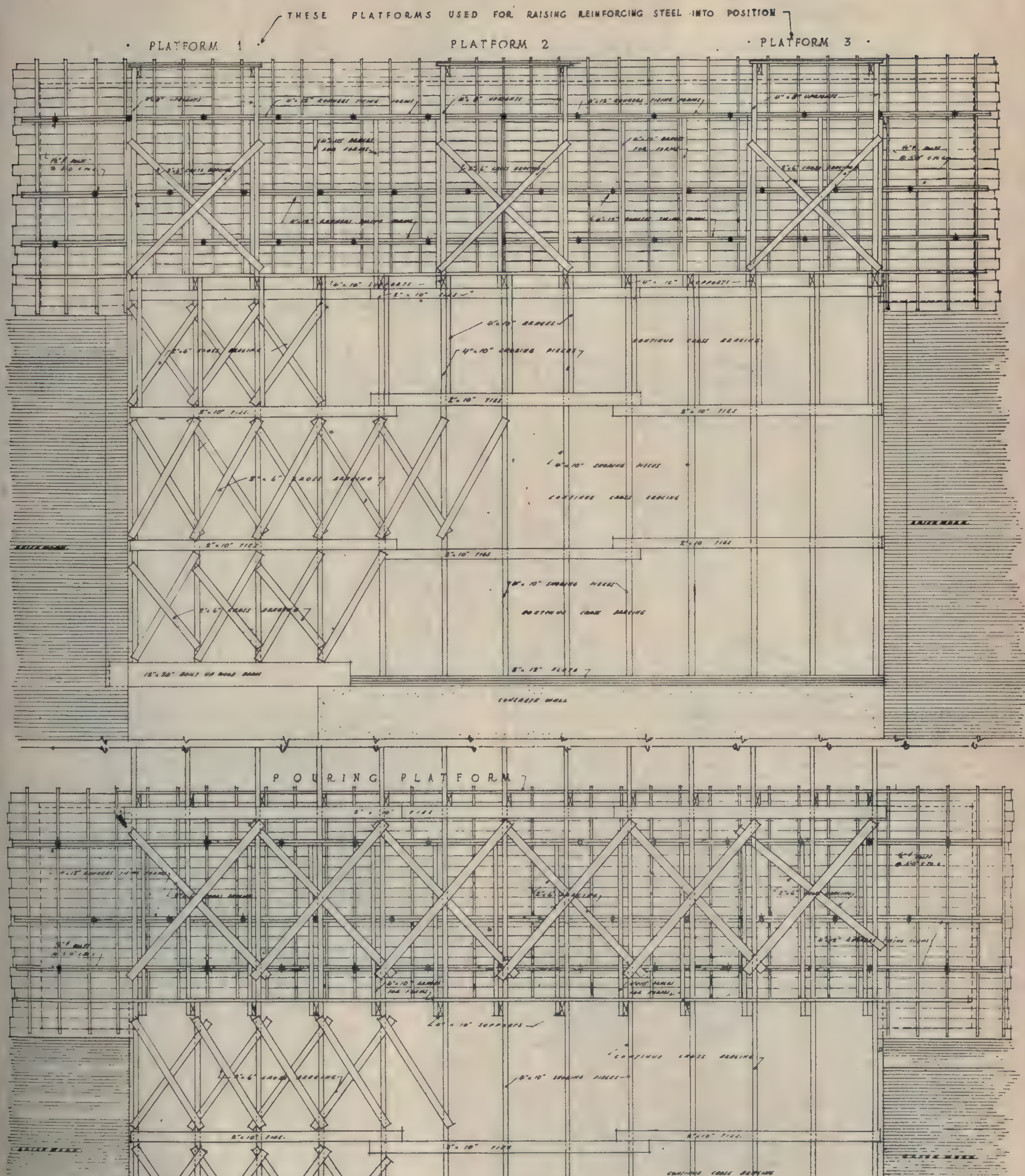
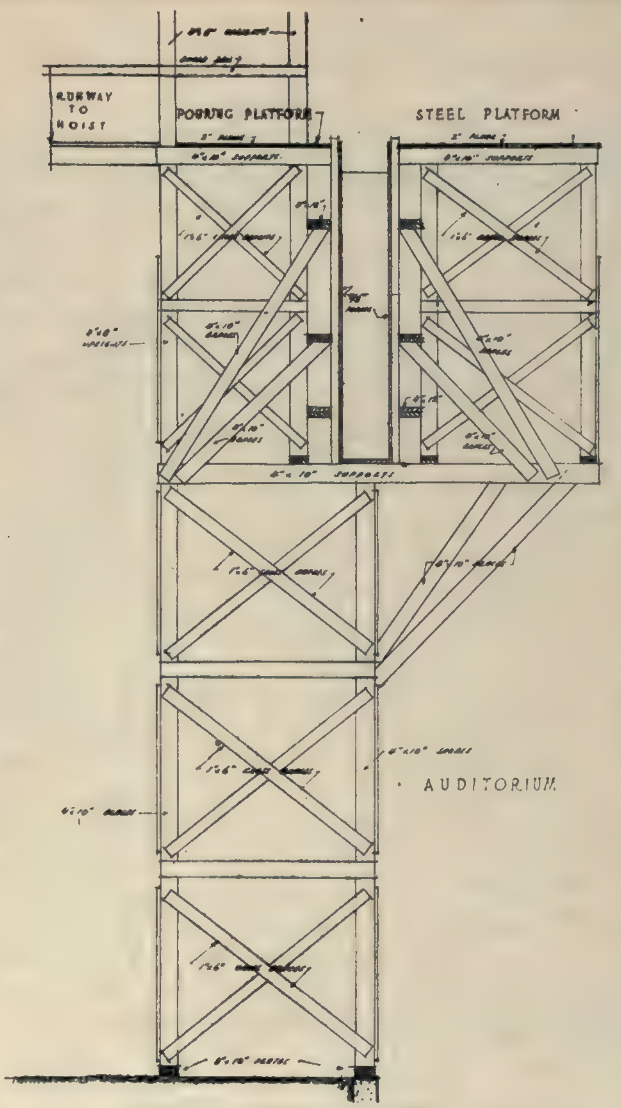
*General superintendent, Jackson-Lewis Co., Ltd., contracting engineers, Toronto.

The proscenium girder from the auditorium side, showing heavy shoring. The three platforms projecting from the side forms are for handling the steel reinforcement

A view of the girder forming and bracing from the stage side. Note the concrete pouring scaffold and the three platforms for raising steel



Upper, elevation of formwork for proscenium girder from auditorium side; lower, elevation of formwork from stage side



Section of formwork and shoring

The location of the platforms is shown in the cuts. In pouring, the concrete was hoisted to a runway and distributed by buggies.

The architect for the theatre is Thos. W. Lamb, Toronto and New York, and the work was executed by the general contractors for the building, The Jackson-Lewis Co. Limited, Toronto.

Canadian Good Roads Congress at Winnipeg

The seventh annual Canadian Good Roads Convention will be held at the Royal Alexandra Hotel, Winnipeg, on Tuesday, Wednesday and Thursday, June 1, 2 and 3 next. The convention will be held in the banquet hall of the Royal Alexandra Hotel, and there will be an exhibition of road materials in the old ball room, while in the large space to the rear of the hotel will be road machinery in actual operation. In addition to this it is proposed to build a length of road on the most modern methods during the convention under the supervision of road builders and engineers.

Drummondville, P. Q., is the scene of great building activity, due to the establishing of several new industries in the town. A new building two storeys high and two hundred feet long is nearing completion, and it is expected everything will be ready for the installation of the machinery by May 1st. This is being built by Messrs. A. F. Byers and Company, contractors, Montreal, for the Butterfly Hosiery Company, a subsidiary of the Chipman-Holton Corporation.

The Jenckes Spinning Machine Company, Pawntucket, Rhode Island, have acquired acres of land adjoining the Canadian Pacific Railway tracks, and it is their intention to build a five-storey factory as soon as the frost is out of the ground. The building will cost in the neighborhood of one million dollars. and an additional million has been set aside for machinery and equipment. It is the intention of the town to erect one hundred and fifty workmen's dwellings, for which plans are now under way.

Road Scarifier that May be Attached to Road Roller

The accompanying illustration shows the Buffalo-Springfield patented pressure scarifier, which is now being manufactured in Canada, under rights, by the Waterous Engine Works Company, Brantford. This scarifier has many features to recommend it to roadmakers. One of its principal advantages is that it is always ready for use, being permanently attached to the roller, and at the same time does not interfere with the operation of the roller in any way when not required. It does not need any extra labor to handle it, as the man on the roller has full control of it by the operation of a single valve. The pressure is applied through the steam cylinder, which has a long stroke piston and gives sufficient force for tearing up hard stone roads, maintaining uniformity in cutting depth on uneven surfaces. At the same time there is enough elasticity to cause the scarifier to raise automatically on striking a hidden boulder or other immovable obstruction, thus frequently preventing breakage of teeth. It scarifies, at the regular travelling speed of the roller, a width of approximately 6 ft. Both depth and width of cut can be varied to suit different conditions. Another feature is the separate arms for each digging tool, which prevents the clogging of material ahead of the tooth bars. The cylinder is practically leak proof, so that the use of the scarifier involves very little waste of steam. It is raised from the road by steam pressure, but when not in use is caught upon a hook, and the pressure removed from the cylinder.

Scarifier attachment for road roller

Representatives of Building and Construction Industries Endorse Association Idea at Enthusiastic Ottawa Convention

Definite Steps Taken to Place Contracting Business on Organized Basis and Fit It for the Position Which Its Importance Justifies — A Basic Industry, the Second Largest in Canada

ON the morning of Monday, Feb. 2, the Conference of the Association of Canadian Building and Construction Industries was opened at the Chateau Laurier, Ottawa, with the president, Mr. J. P. Anglin, in the chair. At the morning session, only routine business was carried out. It was decided, on the suggestion of Mr. Anglin, that Mr. Mattice, of Ottawa, should be appointed chairman of the committee on local affairs with power to call on any members to act; Mr. Lindsay, of Toronto, was chosen chairman of the committee on registration; and Mr. Geo. A. Crain, chairman of the committee on finance.

A meeting of the National Council of the Association was held at 11 a.m.—an informal but interesting affair, at which the doors were open to all, and the men present were called upon to stand up and make themselves acquainted. Many of them told what had been accomplished in the local associations and what they hoped would be accomplished by the national organization. Mr. Geo. A. Crain, of Ottawa, pointed out that the Ottawa Branch of the A.C.B.C.I. had been organized within the past year and they had got some of the best men in the city behind the organization which was now sixty members strong.

Hamilton General Contractors Organize

Mr. W. H. Yates, Hamilton, told the meeting that the general building contractors of Hamilton had just formed an association, having some twelve to fifteen members. The general contractors really controlled the situation in that city, Their object was to affiliate with the provincial organization in Ontario and through the provincial organization, with the Dominion association.

Mr. J. M. Pigott, also of Hamilton, said they had come down with some ideas as to changes in the A.C.B.C.I. which would be expressed at the proper time.

Mr. H. T. Hazleton, of Winnipeg, declared that those from the West had come first with the intention of listening and getting acquainted and then of expressing their views. They had had pretty serious conditions in the West during the last three or four years, and felt that anything that could be done to raise the status of the industry should not be neglected.

The attitude of the prairie provinces was modestly expressed by Mr. Wm. Wilson, of Regina, president of the Provincial Builders' Association of Saskatchewan, who said that he and his confreres had come from a young province to learn from the men in the East.

Mr. J. K. Thomas, coming from Calgary, as the representative of the Builders' Exchange in that city, believed there was a lot of serious work to be carried out by the Dominion organization, and he wanted something definite to take back with him to his home city.

Mr. J. C. K. Stuart, of Hamilton, expressed the opinion that the general contractors in all the big cities should be organized and said the Hamilton men had a plan of organization to suggest.

The Form of Organization is the Question

Mr. Anglin stated that this year the A.C.B.C.I. executive had notified all the men connected with the industry in Canada with whom they could get in touch. It need not be wondered at if there was not quite the same enthusiasm as at the first conference. The previous conference had been called practically to meet the wishes of Hon. Mr. A. K. Maclean. The government was anxious to have as many national associations as possible, no matter what party happened to be in power, and the value to it of such organizations was readily understood. They had come together last year to give an impetus to building, and the enthusiasm of that conference was perhaps much greater than they could hope to obtain again, because of that idea of getting something started for the industry. There was also the situation that the contractors were not busy then; they were looking for business, whereas to-day business was looking for them. Much work, however, had been accomplished in the intervening period. The question was what form the organization was to take if it was to be arried on. That the eyes of the whole industry were upon the organization was evidenced by the fact that there had been so many questions and criticisms, knocks and boosts, from all over the country.

On motion of Mr. Pigott it was decided to have a general discussion of the suitability of the present constitution and by-laws at the afternoon session, before referring the matter to the committee for action.

Labor Clauses of the Peace Treaty and the Washington Conference—Hon. Mr. Rowell's Address

At the midday luncheon Hon. N. W. Rowell, President of the Privy Council, was the guest and speaker. On behalf of the Government, he expressed pleasure that this association of building and construction men should again have met in the city of Ottawa, and also stated his personal satisfaction in meeting the members of this organization, because it was composed of men who were accustomed to doing things and were aiming to build up rather than tear down. In these days when so much criticism was in the air, it was refreshing to meet men who were devoting their energies to construction.

The speaker mentioned he had just recently taken the opportunity of going over the new Parliament Building. The building had impressed him greatly, and he felt it would be a true monument expressing Canadian national ideals. In looking over its fine proportions, one could not help feeling that before the work was started some man had planned it all out, having a big ideal in his mind, which he had expressed in plans and specifications. And there could be no great constructive work undertaken without first the formation of an ideal which might be embodied in practical form. It occurred to him that there might be some thought there that could be applied to existing conditions. It was a national misfortune when the old Parliament Building was burned down, but the new edifice would better express national ideals. Just as, when the delegates met at the Peace Conference, they faced a condition in which the whole structure of European society was practically in ruins and they had to start out and build a new structure. It was their duty to re-establish international relations either on the old basis or on a better one, and the provisions of peace embodied two ideals, which the delegates of the peace conference had in their minds and sought to express in this Treaty of Peace. As they looked out on the international situation, they saw that old theories had failed in the gravest crises of modern history. The old idea was that each nation should look on every other nation as a potential enemy, and arm itself for defence and for aggression. Some of them had the idea that the greatest success could only be achieved at the expense of their neighbors. The balance of power was simply an attempt of various groups to get together and secure sufficient strength to balance against other groups. They might have re-established on this basis, but the experience of the war gave them a larger idea. They saw that instead of looking on each other as potential enemies, they should look upon each other as potential friends, if not real friends, and that each would achieve most if they had the co-operation of all. This was the basis of the League of Nations. Whatever its weaknesses and lack of moral authority, due to the absence of one great power, the speaker ventured to think that in the League there was embodied a great ideal, up to which our humanity had been working during the centuries, and through which, in the spirit of fellowship, peace would finally be established.

Settle Class Differences on New Principle

The statesmen had also another ideal before them. Just as they were working out a pacific method of overcoming international disagreements and aiming, if possible, to remove the arbitrament of war, so too they conceived the idea that in the great class conflict which has been developing in recent years—much more on the European continent than in this country—the time had come when they should seek to settle the differences of Capital and Labor on new principles. The situation in Europe was illustrated by Russia. There was an autocratic government, which had oppressed and tied down the working classes, and then came the reaction which brought about the other extremes—an autocratic government of the working classes, denying rights to all others and claiming that class war must be carried on until Capital had been disintegrated and destroyed.

The Peace Conference had the idea that the best interests of all were not to be found in conflict, but in co-operation, and that it was only through the spirit of co-operation that the world's production could be maintained and increased. Therefore they established another organization known as the International Labor Organization. It would, however, have been more accurately called the International Industrial Organization. This organization was composed of four representatives from every member of the League of Nations—two representing the government, one from the employers and one from the employees. The employers' representative was to be chosen by the Government in co-operation with the existing employers' organizations; similarly with the employees. The organizations to be consulted in Canada were the Canadian Manufacturers' Association and the Trades and Labor Council.

The Washington Conference on Eight-Hour Day

Mr. Rowell made particular reference to the work of the Washington Conference in connection with the eight-hour day and 48-hour week. The action of the Government delegates at the Washington conference in approving the convention relating to the eight-hour day and the 48-hour week, is being criticized in some quarters. It is said Canada should not be a party to any international convention on this matter, nor should any legislation be enacted dealing with it; that such legislation is wrong in principle and particularly inopportune at this time. These critics cannot have read the Treaty of Peace. The treaty declares that "the peace and harmony of the world are imperilled by reason of the existing conditions of labor," and that among the improvements urgently required, is one "regulating the hours of labor, including the establishment of a maximum working day and week," and further that the adoption of an "eight-hour day or a forty-eight-hour week is the standard to be aimed at where it has not already been attained."

Purpose of Conference

"The object of the Washington conference was not," Mr. Rowell declared, "to discuss the principle of a maximum working day and week, or even of the desirability of an eight-hour day or 48-hour week; these matters were settled by the Treaty of Peace. The object was to see if it was possible to secure international agreement in the form of an international convention as to the application of these principles already established by the treaty, to the varying industrial conditions in the different nations party to the treaty. The conference did reach such an agreement which every nation represented at the conference approved. Should Canada have stood out and said, "No, though we signed the treaty containing these provisions, it is but a scrap of paper and we decline to recognize its obligations?" Would the Canadian people be proud of their own position or of the Government that represented them at the conference if we had taken this position? Would you like Canada to be the first nation to repudiate its obligations under the treaty? There was only one honorable course for the Government of Canada to pursue at the conference and that was to recognize the obligations assumed under the treaty and honestly endeavor to carry them out. We stand to-day on the position taken at the Washington Conference."

Eight-hour Day or Forty-eight Hour Week?

Referring further to the discussion at Washington on hours of labor, Mr. Rowell pointed out that one of the main points of difference between the employers and employees arose in regard to whether the clause of the treaty, in question, should be interpreted as recommending a straight eight-hour day, or a forty-eight hour week. The workers contended for the straight eight-hour day, while the employers held out for the forty-eight hour week. The employees argued that if the latter interpretation were put upon the clause, it would permit of the employer requiring them to work perhaps ten or twelve hours for a few days, and shutting down during the remainder of the week. The employers, on the other hand, pointed out that if the straight eight-hour day were put into effect, it would mean a 44-hour week, inasmuch as the Saturday half-holiday had been established in a great many industries and could not now be eliminated.

It was finally decided to appoint a committee of the Conference composed of five employers, five employees and five representatives of the Governments to meet together and see if they could not agree upon a compromise that would be fairly acceptable to all. Canada was represented upon this committee. A conclusion was reached that where men work less than eight hours on any day, the length of the other days may be increased, as in the case where the Saturday half-holiday is in effect.

Special Conditions in Certain Industries

"It necessarily follows that there are certain very important considerations with regard to special conditions that cannot be overlooked. It is recognized that this provision could not be applied to all industries. There are industries which must be excepted from such regulations, and special provisions are made for this purpose in the terms of the Convention, as follows:

" '1. The Convention applies to industrial undertakings only, not to commerce or agriculture and the competent authority in each country must define the line of division between industry on the one hand and commerce and agriculture on the other.

" '2. It is provided that the working hours of those employed shall not exceed eight in the day and forty-eight in the week, with the following exceptions:—

(1) Persons holding positions of superintendence or management or employed in a confidential capacity.

(2) Where the hours of work on one or more days of the week are fewer than eight, the eight-hour limit may be exceeded by not more than one hour per day. To illustrate: Where a Saturday half-holiday is granted the hours of work on the other days of the week may be eight and a half or nine as the case may be so long as the forty-eight hours per week is not exceeded.

(3) Where persons are employed on shifts, the 8-hour day and 48-hour week may be exceeded provided the average number of hours over a three weeks' period does not exceed eight per day and 48 per week.

(4) The limit of hours may be exceeded in the case of accident, actual or threatened, or in the case of urgent work to be done to machinery or plant.

(5)The limit of hours may be exceeded in those processes which are required by reason of the nature of the process to be carried on continuously by a succession of shifts, subject to the condition that the working hours shall not exceed 56 in the week on the average.

(6) In exceptional cases where it is recognized that the limitation of hours of work to eight per day and forty-eight per week cannot be applied, agreements between workers' and employers' organizations concerning the daily limit of work over a longer period of time may be given the force of regulations if the Government to which the agreement shall be submitted, so desires. But the average number of hours worked per week over the number of weeks covered by any such agreement, shall not exceed forty-eight. This exception would cover the situation on our Canadian railways, where it is necessary for men to work longer than eight hours a day and where in some weeks they may exceed forty-eight hours per week, provided that in the total period covered by the agreement the average does not exceed forty-eight hours per week.

(7) Regulations shall be made by public authority determining:

(a) The permanent exceptions which may be made where the work is preparatory, complimentary or intermittent in its character.

(b) The temporary exceptions that may be allowed, so that establishments may deal with exceptional cases of pressure of work. It was stated on behalf of the committee which recommended the convention to the Conference that this clause was intended to cover seasonal employments where, owing to the limited period of the year during which work could be carried on there is exceptional pressure of work during that period.

" 'These regulations, however, must fix the maximum additional hours in each instance and the rate of pay for overtime shall not be less than one and a quarter times the regular rate.'

Conditions in the Orient

"When this compromise was submitted to the the Conference it was adopted by a vote of 98 to two. The provisions it embodies are to be brought into effect not later than July 21. It can however, be denounced ten years from that date. Most countries represented at the Conference already have the eight-hour day and in many cases, the 44-hour week.

"It was recognized that there were certain countries where special treatment of the situation was necessary. Japan, for instance, has at present a working day averaging twelve hours, and the only limitation is that providing that women shall not work more than thirteen hours. There is no Sunday, and but two holidays per month. How the Convention should apply to Japan was a very important question. It was determined that Japan should at once cut down her working day to nine hours, and the Conference recommended that persons under 15 and all miners of whatever age working underground, should not exceed 48 hours a week and persons over fifteen should not exceed 57, except in the raw silk industry where the limit was placed at 60 hours. It was also provided that there should be weekly rest periods of 24 consecutive hours. This recommendation, which was accepted by the Japanese delegates, involves a bigger reduction in hours than in any other country.

Canada Has to Fear Competition of Oriental Labor

"In many lines of industry in Canada, the competition most to be feared is the competition with oriental labor. Japan is becoming rapidly industrialized and when China becomes industrialized the pressure of competition will be very great. Does it not mean a great deal, therefore, if these countries are brought into line with other countries in the matter of labor conditions? In India the principle of 60 hours per week has been adopted for all workers. China, Persia and Siam are to be considered later.

"These conditions are to be submitted to the Governments concerned, and it is for them to decide whether they shall be accepted. If the competent legislative authority refuses to approve, the countries have no further responsibility in connection with them. The adoption depends upon public opinion."

Following Hon. Mr. Rowell's address, Mr. Anglin called upon Mayor Fisher, of Ottawa. The Mayor's remarks were brief, but humorous and illuminating. "Contractors," he said, "are without doubt the most important section of our community and of the community in general. I speak advisedly—first, because I am speaking to contractors, and secondly, because I make my living chiefly in the law business, out of contractors."

He did not look with too much favor on the cost-plus system, because, as he pointed out, now that race track betting and all that sort of thing was to be cut out, the old way of contracting still gave a man a chance to do a little bit of gambling.

In his own work he found himself up against some of the problems the contractors had to solve. They heard a great deal about changes in regard to wages. The old idea was that labor was a commodity, the price of which was to be determined the same as any other. That idea, theoretically at least, had gone by the board.

The Broad Purposes and Far-Reaching Effects of the A.C.B.C.I.—Address by Mr. J. P. Anglin

The afternoon sesion opened with Mr. Fred Armstrong, vice-president, in the chair. Mr. Anglin presented his presidential address, which follows:

The last conference we held was fifteen months ago. That conference, as has been mentioned, accomplished a good deal more than we can probably ever realize. It was a conference full of enthusiasm. We had come here with the idea of taking hold of reconstruction and everything that it meant to us as an industry and also to the country as a whole. The conference held at that time, decided that it would be advisable to have a Canadian-wide association and, as a result, we organized the Association of Canadian Building and Construction Industries in its present form. Since that conference the officers have been carrying on in the interests of the industry as a whole as far as possible.

When I was chosen president some of you will remember that I asked those present to always bear in mind that a man had his own business to run. Nevertheless, gentlemen, I can assure you that I have at all times endeavored to work in the interests of this industry and of the industry as a whole in its relation to the best interests of Canada. We held, a little less than a year ago, a meeting of the National Council in Toronto. It was well attended and it was characterized by enthusiasm and good work. We carried the organization of the association quite a step further on its road and appointed at that meeting a general secretary. There were various reasons why we should at a later date accept the resignation of the general secretary. We then appointed Mr. J. C. Reilly, who is our present acting general secretary.

Mr. Reilly has endeavored in the few months of his tenure of office, to cover the country, and get acquainted with the association. The result of his work may be seen not only in the organization of a number of new contractor bodies throughout the country, but also in the attendance from the West and other parts of Canada to this conference.

So far the attendance of this conference is to a large extent, different from the attendance at our conference of fifteen months ago. This difference, I think, does not need to be accentuated, but I must say—and I can safely say it in your presence—that for quality I consider it unexcelled.

Recognized as the Representative Body

We, during the period since the last conference, have been recognized as the representative body in the construction industry by the Federal Government. We had six representatives at the National Industrial Conference which was held in Ottawa last fall, and I think those who represented you at that conference did their utmost to uphold the dignity and position of the large industry which they represented. We have carried on other activities chiefly in committee, and some of them personal. We have kept in touch with the Department of Labor on questions concerning our industry and, as I say, we attended this industrial conference. These, perhaps, are the two official capacities in which we have appeared. Your president was called in originally when the commission was appointed which brought in the report which resulted in the calling of that conference, and was instrumental in having one of the members of that commission selected.

J. P. Anglin, the President of the Association of Canadian Building and Construction Industries

Now, coming down to the present conference, which is, after all, the most important part of what I want to say, let me state that my own feeling in calling this conference was that the proceedings should not be similar to the proceedings of our other conference, and chiefly from this aspect: I felt that this conference should be the spontaneous expression of the opinions and experiences of those who were gathered together and not a conference which would work along set lines such as our first conference necessarily was. For that reason our programme is open to all kinds of modification and the whole conference is in your hands.

Reasons for an Association

As I see it, the chief objects for having any Canadian association whatsoever are (1) to reduce the difficulties that surround those engaged in our industry—contractors, supply men, and all; (2) to improve the practices that are current among us: (3) to fix standards such as many of you can readily call to mind, and which can be fairly and uniformly applied throughout the country, (4) to facilitate the movement and employment of labor, and, finally, (5) if possible, to work out some sort of a plan which will help in the production of building materials, and bring it up to the great need which exists at the present time.

Why all these? It seems to me that we should bear in mind at all times that we are anxious to improve the position of our chosen industry in the business and financial world. Business, outside of our own industry, has in the past treated contractors more or less as a joke. and finance, as represented by the banks, has put us almost at the bottom of the ladder. These two conditions certainly are improving, but there is a great deal of room for further improvement. Mayor Fisher mentioned the gambling element in contracting. I had intended to mention that by saying that it was something like stock gambling—the few successful ones ultimately failed unless they retired at the opportune moment. This has been the history of the contractors of Canada, and it is up to us to so improve conditions as to ensure that that kind of thing shall not continue.

How Improve Conditions

How can this be done? I have been talking of why, but now the question is: How? There is only one thing for it, as I see it. In the first place it should be the duty of all of us engaged in the industry to help the honest, straightforward and legitimate contractor and material man, and to make it difficult for the unsound firm lacking either in experience or strong financial conditions to engage in the business. Make the industry, if possible, one that would be entered into by worthy men and worthy men alone. Certainly we cannot accomplish this end by the usual underhand and so-called cut-throat practices in the past; certainly not by the free-for-all, or every-man-for-himself, disorganized industry, which has prevailed hitherto.

Organization Must be Dominion-wide

What is needed in order to attain the end desired? We need to increase efficiency, to lower costs and, if possible, to establish for our industry regular and steady earnings. After all, we must always look to that end if we are to be successful. We can no longer localize our organizations. The operations of all the larger general contractors, trade contractors, supply houses and building material manufacturing concerns cover many cities and towns, several provinces and, in some instances, the whole Dominion. Provincialism, therefore, is not the basis for our organization, as I see it. Even the east and the west are disappearing and Canada is our field. If organization has any value to the broadminded business man, it must be Dominion-wide, it must be centralized and efficient, and it must be properly founded and sufficiently financed. Does our own employee, the worker in stone, or marble, or concrete, brick or tile, wood or metal, leave it to George, or does he get under his Union? Does he centralize authority, and does he obey its mandate and pay the price? The answer to this question is evident on all hands. If there was one thing that impressed me more than another at that National Industrial Conference, which was held in Ottawa, and which has been previously referred to, it was the fact that opposite those employers of labor was an equivalent number of employees and every man who was on the other side of the house was a paid employee of organized labor. Gentlemen, that spoke volumes to me; it made me feel that any industry or that which calls itself an industry is not worthy of being held high in the esteem of the community that is not prepared, to some extent, to counteract that great movement and to pay the necessary price.

The Benefits of Organization

Is it worth while to endeavor to accomplish all this? What are some of the real benefits and what are some of the unreal, or unseen advantages? In the first place, I maintain that the fraternity that one has with his competitors is worth the price in itself; in fact, nothing has given me more satisfaction or pleasure than the acquaintanceship of men who are engaged in the same line of business or the opportunity to discuss the problems, difficulties and troubles and to compare results with those whose calling is the same as my own. To me it is worth the price in itself.

This fraternity leads to the second point, and that is co-operation of effort. There must be co-operation where there is the proper kind of fraternity. Co-operation in itself will lead by the comparison of experience and notes, to increased efficiency in methods of doing business, and increased efficiency in methods will certainly lead in the direction of stabilizing our industry—stabilizing our own particular business and stabilizing the business of those we come in contact with. As a result of that we will be in a position to render the service which the country really demands that we should render.

It sometimes bothers me a great deal, when I take time to dwell upon it, to reflect how little service this great industry really renders, collectively, to the community as a whole. We should bear in mind that, being as we are the second largest industry in Canada, something is demanded of us. If we are able to render that service I think you will all agree with me that we will obtain something from our business —the thing to which we give our life and our time. We will obtain a considerably greater amount of satisfaction and the net result will be a measure of success not obtainable in any other way. This can only be done by the best and busiest men being willing to give a little time and by all supporting the Association. Shall we have it? What form shall it take? Shall it be a federation of separate bodies or an organized whole with autonomous sections and subsections? Shall it be based on the organized district or shall it come up from the organized district, from the provincial organization and into the federal organization; or shall it come direct from the organized district to the federal with a group of local districts in the provinces for provincial matters ?

Whole-hearted Support is Needed

Will we support it with our time and our funds ? Unless we are prepared to give it some time and consider it a part of our business, and unless we are prepared to support it financially, it can never be the success it should be, and it can never render the service to us that we desire.

My question, and I am sure the question that you put to each other, is: Are we prepared and are our conferers at home prepared and willing to back us if we organize this Association on a sound basis ? We should bear in mind, gentlemen, that this construction industry, no matter what part of it we are engaged in, is, after all, our chosen life-work, and demands the very best we can put into it. If we do that Canada may ultimately receive our help and support.

Definite Action

Now, with respect to action. It is all very well to think high ideals and all the rest of it, but they are not worth as much as they should be unless we get down to definite action. We have obtained our charter, but we need to put the finishing touches on the constitution. We must determine the classification and kinds of membership, and we must also determine the relations between the various existing national bodies and between the local bodies in the various parts of Canada and our federal body. There are quite a number of national bodies already in existence, such as the heating and domestic sanitary engineers, the National Clay Products Association and others that some of you can call to mind. Shall we organize, and if we do decide to organize, shall we organize as a number of associations leading up into one large federation ? That would involve the organization of a General Contractors' Association, with a branch possibly in each local district. This General Contractors' Association might be Canadian-wide and lead up into a federation of the whole industry. That would also mean that we would in order to attain the desired end, be obliged to work with a view to organizing the other sections of our industry which are represented here, into a national body. Then there is the question of the method of financing our organization and of whether we shall maintain a permanent office and secretary; the question of whether it is possible to establish standard wages in various parts of the country and the question of the length of time that our agreements with labor should be made, whether they should be short-term agreements or long. We will admit that trade agreements with unions must be based on equity. Are we ready to adopt the principle that these wage agreements shall be made upon the basis that the wages shall be variable with the cost of living ? That is now the case in some localities. Is it possible to compete at the present time for contract work and to what length would we recommend our members to go in bidding for contracts without inserting in these contracts some fixed labor schedule ?

The Labor Problem

When it comes to the question of labor, is it possible to establish a central bureau in Ottawa, or elsewhere, with a view to facilitating the movement of labor in co-operation with machinery already set up by the Department of Labor ? When we are faced with the situation this season, as undoubtedly we will be, in which we are short of labor across Canada, is there any way we can obtain co-operation through the Labor and Immigration Departments in supplying the need in the various districts throughout the country? Would this Association devise, or work out, a sound and attractive apprenticeship or scheme for techincal training ? The machinery is already set up for the establishment of technical training ? What is the attitude of this conference and of those whom you represent towards international unions and also towards other unions or labor organizations ? Do we believe that the industrial council is the best method of determining agreements with labor, and if so, are we prepared to advise its extension to other localities ? What has been the experience of those of us who have engaged in these industrial conferences ? Is there any plan by which we can increase the output of our employees ? Would it be possible to establish standards of day's work, or hour's work, in the building and construction industry, and if so, could we provide an increased incentive in the form of a collective bonus to our employees ?

How Increase Production?

The reason I refer to these things is simply this, that it seems to me that all the talk that is going on about low production throughout the country is simply propaganda that is helping to decrease production. The more we talk about low production the less production we seem to get, and what I have in mind is that if we could start some talk about production that did not have in it so much of the element of criticism, we might be able to start something that would help production, and I am sure you will all admit that it is needed.

Another thing that we need in all localities is some prepared counter demands on labor. I have felt the need of that every time I have met to discuss the agreements with the representatives of labor. They come and present their demands to us as employers. We never seem to have demands on them as employees and it seems to me there are many demands we could make and which they would admit if we only had them gone into and standardized as they have on their side before they meet with us. The building trades have been the battleground for organized labor for years, and they are becoming still more the battleground in some localities. We cannot get away from it and it seems to me that it would be better for us to try and solve the question now, if possible.

Better Arrangement for Supply of Material

Coming to materials, outside of labor at the present time, our greatest need is for better arrangement with respect to the supplying of material. I do not so much refer to the raw material, although I think we are very much concerned with that as well, as to the manufactured building material. We should have such respect for our membership, and those who stand high in the industry, that we are always ready to support one another internally. Special trade discounts to contractors within our Association is our right. We who are responsible men cannot be expected to go on paying big prices to make up the losses occasioned by our irresponsible competitors. In return, the supplier of material who supports the association should be given better consideration. Then there is the question of the relation between the trade contractor, the architect and the engineer. I wonder sometimes if the trade contractor cannot see that by quoting the same price to the owner, the architect or the engineer as he quotes to the general contractor he is hastening his own doom. and that it really acts as a boomerang. We should have a fair and equitable standard of procedure, and that is to see to it that the trade and sub-contractors also get a square deal.

There are a large number of other items which I would like to refer to which can come up in committee, and which are contained in the schedule that has been prepared by way of suggestion to the committee. There are the questions that would come before the Standard Practices Committee. These I will pass over, because they will come up better in the committee work.

A Decade Behind the Times

I will just close by saying that in my opinion there is need to improve the conditions generally, and to remove a lot of the difficulties which are ahead of us in the year 1920, for a more constructive type of propaganda. The truth is that we are at least a full decade behind in the organization of this industry. I wish I could let you all know the experience that I have been through since this association was started. I am sure you would see with me the absolute necessity for having some kind of a Canadian-wide organization for our industry. The service that it could render is away beyond everything I could ever show you. The need is very great; the task is ahead. Shall we do our share, shall we progress or shall we let the tide sweep us back? I say: Let us take up the problem and deal with it because it is worth while.

The Scope of an Organized Construction Industry—Address by Mr. Fred Armstrong

Mr. Fred Armstrong, the Chairman, then addressed the Convention, expressing the viewpoint of the manufacturer:

"In the first place I would like to congratulate the president on his very masterly effort. It must have been a matter of deep concentration and great study. He has presented for your consideration a number of matters that are proper subjects for discussion by this Convention and which, if acted upon, may be productive of good results.

"I was a member of the National Association of Builders and one who attended the convention last year. I felt at that time that it was an inspired movement. As the president explained to you this morning, it was called at the instance of the Hon. A. K. MacLean. That it has worked satisfactorily is evidenced by the fact that the recommendations which were made by that Conference were all adopted by the Government and were made the subjects of subsequent legislation and action.

"But there are other points in connection with the National Association of Builders to which I wish to briefly refer.

Organization Should be Comprehensive

"Of the matters which come to my mind, the first is the question as to the desirability of having an organization and what should be its objects. It appears to me that if we are going to have a National Association of Builders, or of those engaged in the building industry, it would have to be very comprehensive in its objects. It would have to comprehend and take into consideration, all those who are engaged in any capacity in building operations. If you will permit me I would like to analyze what, at least to my mind, would be comprehended by any organization representative of this industry. We would have to divide it into four classes: (1) labor; (2) the individual contractor; (3) the general contractor and (4) the supply man and manufacturer. All of these are integral parts that must be considered if we are going to do anything that would be really effective. For instance, take labor, skilled or unskilled. For my own part I really never could understand why we should call any man an unskilled laborer. I can understand that men must of necessity do the rough work and I suppose these men are what we call unskilled laborers, but as a matter of fact when they have had experience in the performance of their duties, they come to be as skilled as any mechanic in his particular line. If we are going to do anything, let us take into consideration the labor phase of the situation.

J. B. Carswell, First Vice-president, A.C.B.C.I., and chairman of Canadian General Contractors' Assn.

Labor's Activities

"With your president, I had the honor of attending the Industrial Conference held at Ottawa and it struck me at that time that we were far behind in anything we were doing in order to counteract the effects of labor propaganda and organization. Whether we like it or not—and surely none of us like it—even the man in the smallest town who says 'I will conduct my business as I see fit; I am not interfered with by labor'—the fact is that labor has spread its operations into all parts of the country, has divided Canada into zones and has made regulations which apply to every zone from the Atlantic to the Pacific. We had conversations with several of the representatives of labor while they were in Ottawa and they explained the system, and that system means that occupations will be so standardized that eventually there will be hardly any person in any industry who will not come under the power and control of the labor organizations. They seem to be dividing up Canada into zones of forty or fifty miles from a central point and making every industry, whether it be that of manufacturers, supply men, or builders, in any form whatever, subject to their regulations.

"If we are going to do anything effective, or anything that will help the building industry we will have to include in our programme something that is going to protect our interests. That might be one of the objects of our Association.

The Eight-Hour Day Question

"We heard Mr. Rowell explain to us to-day the part which he took as one of the representatives of the Canadian Government in the Industrial Conference at Washington in regard to the eight-hour day. At the Industrial Conference at Ottawa I was one of the delegates who were interested in the eight-hour day as applied to all the industries with, as far as I am concerned, more particular reference to the building industry. Notwithstanding the effort that we made to get closer together, there was a disagreement. Our position not only was sound but was confirmed by the fact that at the Industrial Conference in Washington the representatives of the manufacturers section declaimed against the eight hour day and declared, as many of the delegates did, that no matter what might be the attitude of the League of Nations, on this question, they would not, as a section, abide by the decision. However, when the case was finally presented at Washington—and Mr. Rowell in his address to-day said that the matter was ably presented by the different representatives—the decision was in favor of the eight-hour day. In the final analysis the Canadian Government is supreme and Mr. Rowell tells us that in view of the decision of the Conference they feel obliged to support the eight-hour day. You can see that labor is going to have a firm hold, and what it wants labor is going to get, and that the section of the conference will be confirmed by the Government of Canada. If such is the case why should not an association like ours in Canada have a central body whose duty it should be not only to keep all the members better informed as to possible legislation, but also to suggest measures to remedy the situation so that each contractor will have some safe and sound foundation upon which he can tender and conduct his business in future?

Mr. Geo. A. Crain, Hon. Treasurer, A.C.B.C.I.

Sub-Contractor Must be Considered

"If I might just dwell for a moment on the individual contractor, who, generally speaking, is called the sub-contractor, working in conjunction with those engaged in the general contracting business, I would say that if we are going to be of any use to the building industries we must take the sub-contractor into consideration, and that any legislation which is enacted by this national body must interest and appeal to the sub-contractor. His interests must be protected in the hegemony of the building industry, and he must have a fair show. You can understand that some of the opposition that is presented to this national organization is on the part of the sub-contractors who feel that they are being neglected. I do not know to what extent they are being neglected but they have a feeling that their interests are not being considered. I suggest here to-day that you shall consider their interests and that in the programme, prepared and in the prospectus sent out by this new organization there shall be included some protection for the sub-contractor.

"I can quite understand that as far as the general contractor is concerned—the aristocracy of the general contracting business—they will of necessity make regulations which will be to the advantage of the general contracting business as a whole. It is only fair to say that as a result of the general contractor coming upon the horizon and taking his place in the industrial life of Canada, some of the best buildings have been erected. Better buildings have been constructed because he has the general knowledge and he has the staff that is necessary to carry on the work.

Must Please the Supply Men and Manufacturers

"With him there must also be taken into consideration that humble body of men to which I belong: that is the supply men and manufacturers. You will have to prepare a programme that will please the manufacturer or the supply man. The manufacturer of building materials finds his home in the manufacturers' Association. It is not right that he should do so. His proper place is in the building industry. This manufacturer should find his home in this organization and should be able to look to the builders to act as his business agents, as the men who are interested in using his products in the construction of the works upon which they are engaged. You may think—I know I did when I was in the contracting business—that it makes little difference what material I use as long as I get a profit—but it must be plain to you that in following that procedure you are building up competition for yourself which makes it necessary for the manufacturers and supply men to employ agents of their own to see that their material is used in construction work in Canada. I should think that it would be a great help to an association of builders if, in their programme, they found some place for the builder by which he would get the same consideration that you give to labor and the sub-contractor and, generally speaking to the general contractor, because I feel that it would help the majority in this Convention and that it would always help the majority of those engaged in the building industry in Canada. These are conditions which appeal to me and which you will have to study if we are going to make a success of this association. I think this association will be a success but in order that it may be you must stop thinking provincially and personally; you must think nationally.

Disseminate Information

"While I shall not introduce you to the realm of politics, still I can say to you that I believe the success of the country depends on the upholding of the building industry in all its integral parts. Our association should be formed in such a way that it will work for the general good of the community. You can only do that as a national association. I feel strongly on the point that we should have our headquarters at Ottawa. From Ottawa there should be disseminated all information in regard to supply and construction work. If this association were to form itself in such a way that you would have representatives in all parts of the country and distribute information to them it would do better work than by the mere holding of a convention. As far as my experience goes the organizations that are most effective in the United States are those which have prepared and distributed information relative to the trade. What applies to Montreal may not apply to Winnipeg but there is a general foundation for the whole industry and I am quite sure that a great many of the difficulties which now appeal to a great many men—particularly, let me say, in Ontario, because I come from there—will disappear, and you will be able to form an association that is going to include not only all those who are members now but many others who will be brought in during the course of a year or so. It is not to be expected that we can achieve this result without encountering some difficulties and confusion but the way is open to us and I would suggest that we carefully study the details of the address presented to us by the president to-day and join in an effort to organize an association on a national basis."

Discussion on Constitution and Membership

Mr. Armstrong's address was followed by an open discussion of the constitution and by-laws in order to give the committee the general feeling of the meeting in regard to the final form of organization. The draft of the constitution and by-laws then existing was distributed among those present and taken up clause by clause.

The first clause regarding the name elicited a criticism from Mr. Yates, that it was too long. Mr. Phinnemore suggested that the matter of the name should be left over until the form of the organization had been finally decided upon, so that it would be made to conform to it. Mr. H. T. Hazelton, also thought it would be unwise to decide the name at that time. He emphasized the necessity of a board organization and unanimity of action. Improvement of the whole industry could not be brought about by concentrating effort on one branch of it. He believed he voiced the opinion of the Winnipeg Builders' Exchange, which was 175 strong, when he said that they were in favor of a national organization provided it was not too cumbersome and too expensive and that its objects were clear cut.

Believes in Organization From Ground up

Mr. Thomas of Calgary, said he had been sent to Ottawa by his Exchange to see just how the organization was to be carried out and to report back. He was satisfied that all agreed that there was important work for the organization to undertake—the question as to the method of procedure. From his viewpoint, organization from the ground up was the proper plan, and they could learn something from labor's methods. The first step was to start in and organize the various trades, plasterers, plumbers, etc. The next step was the local trades and labor council, followed on by a provincial organization, and finally by the Dominion Trades and Labor Congress. The opinion of the men of the Calgary Exchange was that the employers must follow close along these same lines if they were to build up a successful organization.

Mr. Anglin pointed out that in choosing the name it had been suggested to have it called merely the Association of Canadian Building Industries, and that the reason for the insertion of the word "Construction" was to make it quite clear to public works contractors men who built bridges, docks and so on, that they were wanted in the organization.

The matter of the name was finally left to the committee.

Discussion on Memberships

There was a considerable discussion on membership. Mr. Anglin referring to the provision for both direct and indirect membership, said it had been thought necessary to establish individual membership in order to raise sufficient funds. He did not think it would be possible to finance the organization through a levy on local organizations. Mr. Yates expressed the opinion that the life of the national organization depended wholly on the local exchanges, and his idea was that the local should elect its representatives to the provincial and the provincial to the Dominion and that all finances should be derived from the locals. Secretaries should be provided for the provinces and for the Dominion who would be in close touch with trade conditions and legislative matters. Mr. Phinnemore urged that the national organization should be broad enough to take in all existing organizations without changing their name or restricting their scope of operation.

Mr. Pigott, Hamilton, said that the general contractors' association which had recently been formed in Hamilton were of the opinion that the control of the association should be from the bottom up. There were the three distinct fields, local, provincial and national. Would it not be possible to so organize that the cities which had exchanges or associations would be made members of a provincial body in each province and that the national council should consist of representatives of the provincial organizations? His idea was that the identity of the unit should not be lost in the Dominion-wide association, but that fixed channels be established through which matters could be passed along from the bottom up.

Mr. Fuller, Toronto, suggested that the local exchanges should have direct connection with the National Association, so that if any matter arose in one locality concerned with Dominion legislation, the exchange could take it up with the National executive without first making it necessary to pass it through the provincial organization and thus incur delay.

Relation to Legislation

Mr. Hazleton urged that they must not magnify the functions of the National association in connection with Dominion legislation, as this would be taken care of to a great extent by more comprehensive organizations. The Canadian Manufacturers' Association, he pointed out, had recently entered the larger association of employers with this in view. He thought, however, that any unit of their Association should be able to communicate direct with the Dominion executive.

Mr. Anglin pointed out that there were only two provinces organized as yet and that this fact must be kept in mind in drawing up the constitution.

Mr. Geo. A. Crain expressed it as his view that the National Council should really consist of an executive committee made up of delegates from the various bodies. He did not favor a cleavage into the three sections—general contractors, sub-contractors and supply men.

Mr. Thomas declared that if the National Association showed itself alive the existing bodies would not be slow to come in behind it, and if some definite action were taken to improve conditions in the industry, the necessary provincial organization and machinery would soon be created to back the association.

Financial Aspect of the Organization

Mr. Hazleton recommended that a committee should be appointed to outline a tentative budget and then fix the fees in accordance with it. Mr. Anglin said he had found among individual concerns a desire to support a Canadian association of some kind, but that local associations had shown themselves anxious to give very little. These local exchanges were supported in almost every case by a fairly nominal fee, from $10 up to, perhaps, $50. While it was very desirable that these local bodies should have membership and representation, yet it seemed necessary to provide for direct membership in order to finance the national association. He did not see how the organization could be run under much less than $7,000 or $8,000 per annum.

Mr. Phinnemore also believed there should be individual membership as well as collective. His idea in regard to the obtaining of fees from the latter was that the local units should pay a per capita tax to the provincial and the provincial to the national.

It was Mr. Pigott's opinion that if the project was to be a success somebody had got to make it his business to go from town to town and do organization work. It should not be left merely to amateur efforts.

The articles in the construction dealing with meetings, government and election, officers, duties of officers, executive committee, standing and convention committees, order of business, expulsion and discipline, audit, seal, arbitration, were referred to the committee for discussion and report.

Mr. D. K. Trotter, Montreal, suggested that the matter of the 48-hour week was one that should be taken up, inasmuch as the labor unions were interpreting the Peace Treaty recommendations as calling for a 44-hour week. There was also the question of whether special arrangements could be made for the building industry, since it was, to a large extent, a seasonal occupation. In Montreal they felt that, in view of this fact, the industry should be allowed some latitude.

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A short general session was held on Tuesday morning at which the final composition of the committees was determined, after which the several committees took up their duties. Mr. Anglin read a telegram from Mr. J. A. McKenzie, of Calgary, expressing his regret that he was unable to attend the conference owing to illness, but that the organization could count on his support. A message was also read from the secretary of the Toronto Builders' Exchange, explaining the absence of Mr. C. Blake Jackson, the president-elect of that exchange, also on account of illness. Following is the personnel of the Committees:

Constitution and By-laws.—H. T. Hazleton, K. C. Church, J. A. Pigott, W. R. Talbot, N. McLeod, E. A. Markham, W. R. Carr.

Labor.—Jos. Gosselin, Jr., Wm. Wilson, A. H. Dancy, G. A. Crain, James Mackie, S. Pritchard, R. J. Fuller.

Business Relations.—W. H. Yates, R. J. Lecky, W. A. Mattice, C. F. Smallpiece, D. H. Lunam, Chas. Secord, J. M. G. Lockerby.

Standard Practice.—J. Phinnemore, J. K. Thomas, J. A. Stuart, W. E. Dillon, A. W. Cassidy, P. E. Galarneau, J. B. Carswell.

The conference then adjourned, to allow these committees to confer.

What the National Federation of Construction Industries Has Accomplished in the United States—Address by Mr. J. C. Frazee

At the Tuesday luncheon, the members of the conference were fortunate in having Mr. J. C. Frazee, secretary of the National Federation of Building Industries of the United States, to address them.

Conditions in Canada and United States

Mr. Frazee recalled with pleasure meeting some of his audience previously at the time of the Industrial Labor Conference, when they had had the opportunity of discussing questions of organization. This morning, also, he had the opportunity of sitting with the committee on Constitution and By-laws, and in the discussion he could see that conditions in Canada and the United States as regards the construction industry were in some ways very different. What he had to say, therefore, about organization work in the United States might not apply in all particulars to the situation in Canada. Proceeding, Mr. Frazee said:

"I am simply going to recite somewhat briefly what we are doing in the United States through the Federation of Building Industries and what we have learned in connection with organization.

"In Canada, United States, France and Great Britain and Germany, there had been a spontaneous movement towards organization of the construction industries as a whole about the same time. It is therefore impossible for any one country to take credit for having conceived the idea of amalgamating all these interests. The greatest promise of the success of the venture lies in the fact that in at least five countries the conception appealed to the hard-headed business men of these countries simultaneously.

"The word "construction" was somewhat indefinite and one of the first things done was to define it. In general, it takes in architectural and engineering projects and everything relating to them. It means the erection of steel structures, storage plants, warehouses, factory buildings, residences; putting through irrigation systems, building railroads, bridges, viaducts, dams, etc.

Construction Industry Produces Capital Wealth

"It is significant that the construction industry produces capital wealth, as distinguished from consumable wealth. Capital wealth constitutes the measure by which the stature of the nation is determined. The construction industry in the U. S. produces, normally, $3,000,000,000 annually in permanent, taxable wealth wealth that is not consumed, as is coal, food, clothing and the many other products classified under consumable wealth. Connected with the industry are the producers and refiners of raw materials—the mines and quarries and the manufacturers who turn these raw materials into finished products. Then there are the distributors, wholesale and retail, the general contractors and the sub-contractors, the engineer and the architect, and last, but not least, the financier. The construction industry in any country is the largest industry in that country, producing more wealth and having its activities more widely disseminated than any other—with the exception of agriculture. The wages received by the employees go out immediately into other activities in the locality, and as a consequence the condition of the construction industry is immediately felt and reflected in all other lines of business. The construction industry furnished, last year, more than one-quarter of the railroad tonnage of the United States. In addition to the fact that it is producing capital wealth, the volume and wide and even spread of construction activities make the industry one which, if properly organized, must become the most powerful and influential business in the country.

Co-operation Idea Gaining Ground

"There was a time some years ago when the individual business man believed in standing absolutely alone. He was in competition with other men in his line of activity and was somewhat opposed to the thought of forming business associations where he would deal with his competitors in a co-operative rather than a competitive way. Then some one coined the happy phrase, 'Competition is war—and war is Hell,' and I think that had a good deal to do with the establishment of organizations in the United States. Such organizations are not for price fixing purposes, in opposition to Federal laws, but for the furtherance of the interests of the industry along perfectly legitimate lines. At any rate in the past ten or fifteen years there has been a marked change in the sentiment of the individual business man, and he has become persuaded in the main that it is a better policy to co-operate through business organizations than that he and his competitor should try to cut each other's throats. In that way there has grown up in the United States a very large business organization in the construction industry—some hundreds of associations having to do with special construction activities. There are the common brick, face brick and paving brick manufacturers' associations; the hollow tile manufacturers' association, and so on—all dealing with almost the same product and having organizations of their own. Then there are the various associations of the lumbermen—the national lumbermen's association, the hardwood lumber association, and other lumber producers' associations; also the national wholesale lumbermen's association, and the national retail lumbermen's association, these having their organizations further subdivided in their production and distribution aspects. Besides there are a whole family of state associations, and these are subdivided again, until you find the Wholesale Lumber Association of Chicago, and so on it goes.

"The result is that there are national associations, regional and state associations and local associations, to the number of some hundreds, all of which are dealing with one or another phase of the construction industry.

Competition Between Associations

"There has been up to the present time, and there still remains to some extent, the same type of competition between associations that there was between individuals. Specifically, the cement interests and the brick interests feel they are most serious competitors, and the triangle is completed by the lumber interests. Thus there is a condition at the present time where the feeling which formerly existed between individuals now exists between the associations, and the next logical step is to obtain a co-operation between all of these through a central organization.

Organization in the United States

"To the thinkers in the five countries mentioned, not many months ago, this thought seemed to appeal at the end of the war with tremendous force, and in the United States we have been trying to bring this into existence. The many organizations have interests peculiar to themselves, but there are also interests which involve the entire group. All branches of the industry, the man who makes plate glass, the lumberman, the contractor, and so on, have certain things in common. Up to this time they have not gotten together, with the result that there is a lack of efficiency, a loss to themselves in other causes, and a general misunderstanding and failure to realize the best that is possible for the industry. During the war the United States Government, through the War Industries Board, attempted to deal with all the construction industries through separate war service committees, but the complexity of the situation made it necessary to request the Chamber of Commerce to organize the entire industry into one organization and so the National Federation of Construction Industries was formed. Following the armistice, a convention was called and it was decided to re-organize into permanent organization for the purpose of accomplishing the results I have outlined. This re-organization was carried out, and the statement of the purpose is as follows:

Purpose of the Federation

The Federation is formed for the purpose of extending construction and improving conditions in the combined industry. It is intended to co-ordinate the several divisions of the industry. In the accomplishment of these results the objects of the Federation are:

To promote closer co-operative relations between producers, manufacturers, distributors, contractors, architects, engineers, realtors, financiers and other construction interests;

To develop and preserve satisfactory conditions in the relationship of the combined industry to the general public, including the Government, labor and consumers;

To serve as an exchange between and common meeting-place for associations representing special construction interests;

In cases where a special construction interest is primarily concerned, to support the initiative of the representative association in all matters considered by the Federation to be within the proper scope of its activities;

In cases of common interest to the construction industry in general, to take the initiative in investigation, policy, propaganda, legislation, and in such other ways as will benefit the industry; and

To provide a united organization which will mobilize the entire strength and experience of the industry.

"As to the organization, we have learned a great deal this year and I shall outline to you just what the Federation is planned to be in the light of one year of rather active effort, and following that picture, I will attempt to outline the advantages of organization.

Country Divided into Twelve Districts

"We are going to divide the United States into twelve districts, known as Federation district Nos. 1, 2, 3 and so on, and these will be co-terminus with the Federal Reserve districts. There will be elected one member to the Board of Directors from each Federation district, and thirteen without respect to place of residence. The Board will elect a president and twelve vice-presidents, each vice-president to act as chairman of his district. We also created an Advisory Board, made up as follows: Any national association which is a member of the Federation may appoint two members to the Advisory Board at large, and one from each Federation district; a regional association member operating over several states but not throughout the whole country may elect one member at large and as many district members as the activities of the association extend into; a local association, whose activities are confined to a city, may elect one district member to the board. In addition, the Advisory Board has power to elect such other members as may be desirable, not necessarily confining themselves to the construction industry, but choosing anyone of prominence, whose judgment is deemed valuable.

"This Advisory board has now 147 members from all parts of the United States, including a number of prominent bankers, industrial leaders and railroad presidents. When we have a matter on which the Board of Directors wishes to take action, we analyze it as carefully as possible and submit it to the members of the Advisory Board on a form, which states at the top, 'Your individual opinion is requested. What you say is confidential. You are speaking for yourself only'. On all questions so submitted we will get a most voluminous analysis. We take these opinions and the committee in charge of the matter under consideration will analyze them, set them out, and lay them before the entire membership of the Federation through the mail. Thus they will have before them, in composite form, the careful thought of these business men of the United States, and they have a basis of study that they could not have if they simply received a copy of a bill in Congress. This Advisory Board digests the matter and it is analyzed much better than it could be by a committee, and it has been found of tremendous assistance to us in handling problems of this kind. It also results in having a group of business men, interested in the Federation and believing that it stands for something, and when the membership campaign opens in their locality these men help it along.

Business Men's Assistance

"Co-operation is the biggest thing in these days, and it would be possible, because of the importance of the construction industry, to get the assistance of any big men in Canada whether they are connected with it or not. The effect of this industry is so great upon industry in general that any good business man is glad to help.

"The National Federation is also going to organize a staff council composed of paid men of the various associations connected with it. Sometimes it happens that several organizations get a hunch at the same time and they flood Congress with petitions and requests, and one section of the industry may be backing one proposition and another something totally different. Many of the organizations have their own lawyers, and we are going to organize this staff council so that all of these legal men will form one division. Many have trained engineers, who will form the engineers' division. Then there are the managers or executive secretaries, who form the executive division of the staff council. The statisticians will form the statistical division, and there will also be an advertising division. In other words, so far as these organizations wish to work on several problems, instead of working sporadically, they will work as a group. You take two or three hundred men getting together in this way and acting in co-operation, and you are going to get a new type of legislation.

Standardization

"Up to the present time there has not been any attempt to standardize building conditions. All over the United States the requirements are different. It is almost impossible, for instance, to manufacture a radiator that will meet the by-laws in all of the states. It is perfectly logical from an engineering standpoint that there should be some one kind of heating equipment, or fire escape or extinguisher, that is better than any other. In some cases patents would interfere with standardization, but it is possible to arrange the building codes dealing with the heating of buildings which would not limit the manufacturer of the equipment to a few patents and at the same time enable him to serve customers in all states.

"What I have outlined above is, in a very brief way, the organization of the Federation of Construction Industries.

"What are the advantages of our organization? If there is not some value accruing from it, it should go out of existence. Some associations are organized for the purpose of pleasure, but these Federated industries are a business organization. It seems to me, from my own standpoint, I can answer the question, 'What are the advantages of organizing the construction industries as a whole?' by reciting what the Federation has done during the first year.

"In considering the activities there are three classes or phases of work. The first phase of work is concerned with the return of industry following the war to a normal business condition. The second is to begin the natural function of an organization, which is the permanent betterment of industrial conditions, and the third is to deal with emergent conditions from time to time as they may arise."

What the Federation has Accomplished

Mr. Frazee proceeded to point a number of improvements effected in the conditions of the industry which had been brought about largely, if not entirely, through the efforts and representations of the Federation: the large government road building programme, involving an expenditure of about $500,000,000 by the

Federal Government, supplemented by the states, counties and townships; the "Own your own home" campaign and the "Build now" campaign, which was taken up by towns and cities throughout the country and gave a big simulus to the industry—these campaigns were organized by the Federation, in conjunction with the Association of Real Estate Boards; assistance to financial situation when loans were difficult to obtain prior to floating of Liberty Loan through representations to the Secretary of the Treasury, who issued instructions to bankers to accommodate legitimate construction undertakings; educational campaign regarding permanency in price level and improbability of any decrease in building costs; reversal of decision of railroad administration to increase freight rates on sand, gravel, crushed stone and slag during 1919; settlement of wage and labor disputes when matters had apparently reached a deadlock; formation of a Board of Jurisdictional Award—eighty per cent. of the strikes in the contracting and construction industry in the United States have been due to disputes as to the jurisdiction of different trades, plumbers going out on strike in protest against the employment of steamfitters on certain classes of work, and so on—all these differences are to be settled by the new board, whose decision will be final; bill introduced for relief of general contractors of the United States whose contracts were cancelled by the Government when the war ended.

Less Work at the Site

In regard to the plans of the Federation for the future, Mr. Frazee said they had a programme which would cover a period of years dealing with the standardization of industry in its engineering, commercial, legislative and business aspects. He pointed out, as an example of the improvement that might be effected, that there was twenty-six manufacturers of freight elevators in the United States, each making, roughly, thirty different types of elevators. The variations in elevators were three, the floor capacity, the mass capacity and the speed, and it was probable that five different types of freight elevators could be gotten up that would be satisfactory to everybody and meet all requirements. If they could standardize the specifications of architects and engineers and those of the elevator manufacturers, it would be possible to produce elevators on a bulk basis rather than on a piece work basis, permitting of the employment of a great deal more labor saving machinery. Also, when it was realized that eighty to eighty-five per cent. of the costs of the construction industry were labor costs, it could readily be seen that through standardization and the carrying out of more work in the shop with labor saving machinery and less work at the site, the cost of production could be considerably decreased and its volume increased.

Among other activities of the Federation was a private campaign among its members to keep down the cost of building. When the capacity of the plants became inadequate to meet the demand, the profiteering instinct began to develop, and the Federation started a hard campaign against it, pointing out that further increase in building costs would add to the cost of living and result in more serious labor troubles. As a result the prices of construction had been kept 23 per cent. lower than the average of all other materials.

"Organization of business along the proper lines," said Mr. Frazee, "is not a menace to the government, nor to labor, nor to anybody. There are always some short-sighted individuals who will do the wrong thing with respect to labor or prices, and if you have a strong organization with the best brains behind it—and remembering that only a small percentage of business men are rascals—conditions are going to be better rather than worse, because the tendency of the few is going to be curbed by that organization. If you are to avoid radicalism in labor you will have to be sensible and just—not necessarily foolish or sentimental. There are just as basic considerations in regard to industrial relations as in regard to railroad rates or production cost, and the trouble is that business men have paid more attention to the latter than to the former. If you can have a construction organization properly guided and directed to deal with the labor organization, you are going to be able to deal with the situation in a just and intelligent way."

Foreign Trade Division

Another undertaking of the Federation was the formation of a foreign trade division, which sent out letters to individual members advising them that in various parts of the world certain materials were required which could be supplied by America. They had contracts made with every possible source of information in the world in regard to demand for materials which America could furnish.

The Federation had also been instrumental in relieving the situation as far as some of the construction industries were concerned which were placed in a very serious position at the time of the coal shortage. Mines and quarries were being flooded with water as they had no fuel to operate their pumps, and in many plants the Uuderwriters were getting ready to cancel their insurance due to the fact that they could not keep their fire protection apparatus from freezing. Through the representations of the Federation to the Fuel Administration, arrangements were made for the supply of fuel to overcome this serious situation.

In conclusion, Mr. Frazee said, "There is a big place for an organization representing the construction industries as a whole. You have got to realize that two things are essential—money and service. First you must get the money if you are going to have the organization, and secondly you have got to be willing to serve on committees—and those committees have to be run so that they do not go to seed. At the present time you must realize it is an altruistic effort on your part. You must convert the doubters later, and if you do you are going to organize the biggest industry in Canada. I extend the good wishes of the directors of the National Federation of Construction Industries for your success."

Minister of Labor Speaks of Labor Distribution

Senator Gideon Robertson was also a guest at the Tuesday luncheon and was called upon. The Senator said he sincerely appreciated the opportunity of hearing Mr. Frazee's address. It indicated to him great possibilities wherein their own organization could lead the way and establish relations between the employers and workmen throughout the country. The effect for good upon the whole of the people would indeed be boundless. He looked upon the growth of this organization as a matter of national importance on this account.

The speaker referred to the arrangements made in co-operation with the provinces, for the systematic employment and distribution of labor. This action had been taken in the first place because of conditions arising out of the war and the anticipation of a serious situation. The chain of employment offices established as a result had proven to be satisfactory. By reason of the co-operation of the employers the Federal Employment Service had grown splendidly and, in proportion to the population, had accomplished more than was the case in any other country in the world during the first year. From March, 1919, they had placed more than 226,000 men, of which something like 37 per cent. were returned men.

During the war, it might be necessary for governments to indulge in certain policies which seemed dictatorial, but in peace time, his opinion was that no such tendency should exist, but that the purpose of the Government was rather to promote any undertaking for the benefit of the people as a whole. In regard to the employment offices, he had hundreds of testimonials on record asking that they should be continued. If the experience of the building industry with them had been satisfactory, the government was very pleased, but if on the other hand they had experienced any unsatisfactory conditions, the government would be glad to know about them also.

Canada Has Passed Well Through Trying Period

"I think," continued the Minister, "you will probably agree with me that in the fourteen months we have passed through since the armstice was declared, the dislocation of business and unemployment which we feared and anticipated did not materialize, and we have reason at this time to feel gratified that Canada has passed through this trying period as well as she has. I think it is true that our industrial situation compares favorably with that of any other country participating in the war and I am confident that the future for this country is bright and opportunities for your own industry development unbounded. We need have no fear of any great disaster coming to this country as has been the case in other nations.

"Your organization has been in existence for a year, and I take it that the interest that caused you to maintain it will lead you to carry it on successfully. After the address from your guest to-day, I am sure you will be more than over anxious to maintain your co-operative effort, to perfect the organization you have started and to make it useful not only to yourselves and the thousands of men in your employ, but also that you will use it as an instrument that will be a blessing to the nation at large."

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A telegram was read from the Engineering Institute of Canada expressing appreciation of the action of the executive in postponing the conference so as not to clash with the Institute's annual meeting, and extending hearty greetings and good wishes for success.

Changes in Constitution Provide for New Grading of Members

Tuesday afternoon was spent in committee work, and the Conference met again in General Session on Tuesday night. The first action taken was to wire a vote of thanks to Mr. Frazee for his address at the luncheon.

A finance committee was appointed consisting of Mr. Geo. A. Crain, (chairman), Chas. Smallpiece, W. E. Dillon, James Mackie, J. K. Thomas.

A report of the committee on Constitution and By-laws was presented by Mr. Hazelton in the form of a draft of a new constitution and by-laws submitted for the approval of the Conference.

The main features of the report consisted in changes in articles Nos. 3 and 4 of the printed draft of the constitution. These new provisions were as follows:

Classes of Membership

The membership in the Association shall be of two classes, "Collective" and "Individual."

"Individual" members—Any individual, firm or corporation engaged in any branch of the construction industry is eligible for membership.

"Collective" members—Any group of individuals, firm, or corporations engaged in any of the building industries, either local, provincial, or national, organized into such bodies as, Builders' Exchanges, Trade Associations, or branches of such bodies as Boards of Trade that pertain to any of the building industries.

"Plural" Membership—Any individual or collective member shall have the privilege of obtaining multiple memberships.

To facilitate the objects of the Association, the membership may be organized into three sections, namely: (a) general contractors and contracting engineers; (b) trade or sub-contractors, and (c) supply firms, manufacturers and producers of building material and plant. Each section may be further subdivided.

It is recommended that existing organizations where possible re-organize themselves into, and new organizations where formed shall become, branches of this Association under the regulations here laid down for "collective" members, with the aim that the country may ultimately become organized into local groups which would in turn form provincial groups, and these in turn elect an equal number of official representatives who combined, one province with the other, would form the National Council, and the business of the Association shall be dealt with by committees struck by this National Council so formed.

Fees

Membership fees for collective or individual membership including multiple membership shall be $25 per annum for each membership, payable upon election, and annually thereafter on the 2nd day of January, providing, however, that in the case of Provincial or other similar groups of organizations where same are formed of collective members they shall not be expected to pay a further membership fee.

National Council

The affairs of the Association shall be managed by a National Council composed of the five officers elected at the annual general meeting and three councillors from each of the provinces of the Dominion of Canada.

The three Provincial councillors shall be elected by the Provincial Associations composed of all memberships in each respective province, in such manner as will provide continuity of office.

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In presenting the report Mr. Hazelton explained that it had been thought best to provide for individual memberships, as well as collective, because Mr. Frazee advised them not to attempt to obtain their entire revenue from existing organizations. While their co-operation was very necessary to the success of the National Association, they could not be counted upon to supply all the funds needed. The idea was to have them come in and take memberships, and to dispose of as many plural memberships as possible to the larger firms throughout the country, which would be principally benefited by the formation of the National Association.

Mr. Anglin pointed out that it was the understanding that if in any province no provincial organization existed, the local bodies could still elect provincial councillors to the National Council. If there was only one local exchange in a province it had this privilege if it were a member of the Dominion body.

Mr. W. E. Dillon, of Toronto, said he believed the Province of Ontario would receive the new constitution with open arms.

Mr. Thomas, of Calgary, also considered it's provisions were excellent.

Mr. Anglin explained, in reply to a question asked by Mr. Dillon, that while a section of a local exchange could not become a direct member of the National Association, they could obtain a membership, indirectly, by sending it through the Exchange. He also pointed out that though a provincial organization obtained one membership in the National Association automatically and without fee, it could secure as many more memberships as it cared to by paying for them.

Report of Committee on Business Relations

Report of Committee on Business Relations by the chairman, Mr. W. H. Yates, was unanimously adopted. Its recommendations were as follows:

Your committee met as instructed and beg to report as follows:

Mr. Yates was elected chairman, and Mr. Lecky secretary.

After considerable amount of discussion, as to the lines on which the Association could benefit the members as a whole, the following recommendations are respectfully made:

"That a standing committee be formed to take up the whole subject of Business Relations—

(1) Between the general contractor, architects and owners.

(2) Between the general contractor, sub-trades and supply houses.

(3) Between the sub-trades, supply houses, architects and owners.

That this committee get in touch with all branches and exchanges throughout Canada and obtain their opinions on this subject, also statement as to their special requirements along these lines.

That this committee then report its findings with suggestions to the National Council of this Association who shall in turn take whatever action they may see fit to improve business relations along the lines as set forth above.

Suggestions

It is suggested for the guidance of this committee, that the following may be considered:

(1) That all members of this association, whether through branches or directly, shall bind themselves to as far as possible deal only within the association.

(2) That some system may be worked out whereby the general contractor shall be protected in return for his undertaking to deal only within the association.

(3) That the uniform contracts, which it is hoped will become universal when they are drawn up, shall include a contract form between the sub-contractor, the supply house and the general contractor along the lines of the uniform contract now in use in Winnipeg, to specially protect the sub-contractor and supply houses as to their payments being made promptly.

Report of Committee on Standard Practices

The report of the committee on Standard Practices was presented by Mr. J. B. Carswell:

The Committee recommends,—

(a) That no sub-division of tenders or unit prices be given to architects or engineers before the contract is closed, or before written assurance has been received that a contract will be entered into.

(b) That architects and engineers be notified that general contractors will not submit bulk competitive tenders where the said architect or engineer is at the same time taking bids on his work by trades.

(c) That the practice of giving certified cheques with bids, both on private and public work be strongly discouraged, and it is suggested that in view of the large deposits which have to be made by bonding companies with the Provincial and Dominion Government, that bid bonds be substituted.

It is recommended that a committee be immediately formed consisting of three responsible architects appointed by the Royal Architectural Institute of Canada, and three members of this Association, and that legal advice be obtained by the architects on the one hand, and this Association on the other hand, to co-operate in drawing up a standard form of contract and general conditions which can be used throughout the Dominion.

Further, that a standard form of sub-contract be prepared, which form should bind the sub-contractor to the same conditions of contract as the general contractor, and assure the sub-contractor of the same privileges and conditions as accrue to the general contractor.

Inasmuch as architects and engineers invariably reserve the right to dismiss any contractor for incompetency, it is recommended that penalty and bonus clauses should be eliminated entirely from construction contracts.

It is recommended that lump sum contracts be strongly discouraged until existing conditions become more normal, and that the "cost plus a percentage" or "cost plus a fixed or sliding fee" form of contract be advocated as the only fair and reasonable basis, from the viewpoint both of the contractor and owner, and that a resolution to this effect be immediately forwarded to the Dominion and the Provincial Governments, and municipal bodies, and to all architectural and engineering bodies interested.

* * *

Mr. Pigott thought some provision should be made in the report for taking care of legal difficulties, inasmuch as most of the laws affecting contractors were provincial, and the first step would seem to be the standardization of these laws. One unreasonable feature in the contract form in use in Ontario was the provision covering the question of hold-back, designed to correspond with the Mechanics Lien Act, which permitted the owner to hold his percentage until 35 days after the completion and acceptance of the building. He had in mind cases where the contractors were kept out of their money for a considerable period of time when there were only small items to complete. His contention was that when a building was practically finished, the contractor should receive his money, allowing only for the estimated cost of the incidentals still to be carried out.

On the suggestion of Mr. Jennings that the committee on standard forms of contract should include engineers as well as architects, it was decided that it should be composed of four contractors, two architects and two engineers.

In the matter of the submission of certified cheques, Mr. Mattice pointed out that in Ottawa they had drafted a resolution to the effect that tenders should be considered immediately after the closing and if the cheques of unsuccessful tenderers were not returned within a week, they should bear interest at the rate of six per cent.

Mr. Talbot, speaking from the viewpoint of the sub-contractor, thought it was only reasonable where a general contractor used a sub-contractor's bid he should advise him before submitting his tender to the owner.

Mr. Dancy, referring to clause (b) of the committee report, pointed out that masonry was a trade that was very seldom sub-let and be felt that the clause would be a bar to the operations of the masonry contractor.

Mr. Anglin pointed out that the clause cut both ways. In some cases the architect preferred to invite tenders from the separate trades, and under these conditions it would benefit the sub-contractor.

Mr. Pritchard thought it would be difficult to tell just where the line would be drawn. In the West they recognized the right of the architect to call separate bids for the heating equipment, elevators and so on.

Mr. Hazelton pointed out that the object of the clause was not in any way to restrict the sub-contractors but to prevent the architect from making up a conglomerate bid and beating down the general contractor by substituting low bids received separately.

The report with changes as noted was adopted.

A Nomination Committee was appointed consisting of J. K. Thomas, Wm. Wilson, H. T. Hazelton, J. M. Pigott, Chas. Smallpiece, John Flood, to bring in a report the following day.

Report of Labor Committee

The report of the Labor Committee was presented by Mr. Fuller:

Your committee on Labor have considered at length the agenda submitted. It will be readily understood that the problems arising out of the consideration of the relations between employers and employees are too numerous and comprehensive to be covered even superficially in the limited time at our disposal. We beg, however, to report the following recommendations:

(1) Admitting as we do the right of labor to organize, we submit that this association should urge that all labor organizations become incorporated in Canada or otherwise be made responsible so that all contracts entered into between organized labor on the one hand, and individual or corporate employers or incorporated associations of employers on the other hand shall be made binding upon each of the contracting parties.

(2) That legislation be sought making compulsory the reference to a Board of Conciliation of all disputes which cannot be settled by the parties directly interested therein, before the employer be permitted to close down his business or the employees be permitted to call a strike.

(3) That this association adopt a policy of having such agreements as are entered into with the labor organizations expire on the 31st day of March, and that a clause be inserted in all such agreements requiring that any new agreements or modifications of existing agreements be executed at least three months prior to the date on which they become effective. Further, that the period covered by such agreements should be determined by the local bodies until the present abnormal conditions be over.

(4) That this association take up with the Dominion and Provincial governments and the reputable labor organizations of Canada the matter of apprenticeship and trade tests along the following lines: (a) The institution of an apprenticeship system in the various trades whereby the apprentice would obtain a practical training under the supervision of practical employers and at the same time a technical training at a Government Technical School. (b) The institution of an examining board consisting of an employer, a labor representative, and a Government repsentative to examine the apprentice as to his mastery of his trade before giving him the rank of journeyman. (c) The conclusion of an arrangement whereby the Union would not admit new members to their organization until the qualifications of such new members had been passed on by the examining board mentioned above.

(5) That when recommendation No. 4 as above shall have been carried out successfully, this association will make every effort to have the unions grade and classify their men using the machinery there set up to determine such grading or classification to the end that the incentive of its logical reward should be placed before the mechanics to encourage their increased efficiency.

(6) That a standing committee or a paid official be designated by this association to get action on these items as rapidly as possible to the end that some of

the objects here laid down may be reported to our next meeting as having been attained.

That the matter of immigration of desirable mechanics be left with the incoming executive, to whom this committee is prepared to present a confidential report.

The entire report was adopted after considerable discussion (which will be a subject of comment in our next issue).

Mr. Phinnemore here made a motion to the effect that the Association should stand behind the contractors who had carried out Federal work during the war and should petition the Government to reimburse those who had suffered losses on Government contracts due to war conditions. Mr. Trotter seconded this motion, instancing one case where a contractor had been out $40,000. The motion was carried.

Mr. Dillon recommended that an official representative should be appointed to attend the convention of the Provincial Builders & Supply Association with full power to act.

The report of the Nominating Committee was brought in by Mr. Hazleton and was unanimously adopted:

Officers Elected

President, J. P. Anglin, Montreal; first vice-president, J. B. Carswell, Toronto; second vice-president, Jas. Mackie, Winnipeg; honorary secretary, Jas. Phinnemore, Toronto; honorary treasurer, Geo. A. Crain, Ottawa.

Conference Invited to Winnipeg Next Year

Mr. Hazleton read a message from the Winnipeg Board of Trade extending a hearty invitation to the A.C.B.C.I. to hold their next conference in Winnipeg. Mr. Hazleton also added his own invitation as president of the Winnipeg Builders' Exchange. The matter was left in the hands of the Executive.

Wednesday Afternoon Session

On Wednesday afternoon at 4 o'clock, the last session of the Conference was held, with Mr. Jas. Mackie in the chair.

Mr. Thomas moved that the executive should take up the matter of publicity and see that the affairs of the Association were kept before the country through the public press. Mr. Anglin seconded the motion, which was carried.

The report of the Constitution and By-laws Committee was finally adopted. The main features of the new constitution are given in a previous page. It was left to the executive to work out any further changes in the constitution and by-laws that might be necessitated in order to conform with the basic alterations.

Mr. Carswell reported that the general contractors had held a meeting and had decided to form the Canadian General Contractors' Association, and on behalf of this new association he made application for membership in the A.C.B.C.I. as provided for in the Constitution and By-laws. The new association had also passed a resolution heartily endorsing the A.C.B.C.I. as now constituted.

Mr. Mattice, Ottawa, reported for the sub-contractors, stating that they thoroughly concurred in the steps taken at the Conference.

Mr. Lunam brought forward a resolution, which was seconded by Mr. Secord, recommending that the executive should take action in regard to the removal of the business profits war tax. This was carried.

Mr. J. C. Reilly, acting general secretary of the association, expressed his appreciation of the kindness which had been shown him while on his trip across the Dominion. He asked the co-operation of those present in securing memberships. If they would arouse the interest of their fellow-contractors in their various localities, the work of the organization would then be greatly simplified.

Mr. Mackie expressed the appreciation of the men of the West of Mr. Reilly's work and promised him their co-operation.

Mr. Anglin thanked the Conference for the honor they had shown him in re-electing him president of the association. He hoped that when the members got back to their various provinces the provincial councillors would be elected as soon as possible.

National Conference on Concrete House Construction, February 17-19

THROUGHOUT the continent there is no more vital problem than that of home building. The very great shortage at present has served to attract public attention, not only to the immediate necessity for more places where people can live, but also to the fundamental need for housing of the sort that makes for good homes and happy people.

The house must be more than a shelter and the community more than a group of houses. Individual ownership of the home place builds good citizenship and creates pride in the community; it stimulates a laudable ambition to acquire, encourages habits of thrift, makes men more steady and efficient in business and industry and provides dividends of contentment to the owner and his family.

The National Conference on Concrete House Construction, which is meeting in Chicago on February 17, 18 and 19, is called to perform two functions: First, to consider the dwelling house problem in the United States and Canada; and second, to present and make available the "state of the art"; in other words, the most modern practice in the construction of concrete houses. The most recent significant developments in the technique of using concrete in the walls, floors and roofs of dwellings a matter of common knowledge, is unpuestionably one of the chief ends to be achieved.

Portable belt conveyors for handling material horizontally or at a slight incline are described and illustrated in a new folder entitled "Type B Portable Belt Conveyors." This folder, just published by the Portable Machinery Co. of Passaic, N. J., contains prices of these machines which are made with 16 in. wide belt and in standard stock sizes as follows: 12 ft. 6in., 16 ft., 19 ft. 6 in., 23 ft., 26 ft. 6 in., 30 ft., 33 ft. 6 in. and 37 ft. These machines, in addition to being used for handling coal, sand, crushed stone, fertilizer, etc., are used for conveying many manufactured products, bagged material such as cement, etc. Used in series or in conjunction with fixed conveying systems, they afford a flexible, convenient conveying arrangement.

The cut stone contractors of district No. 4 were represented by Messrs. Geo. Oakley (Governor of the district), Victor Vokes and Jack Scott, of Toronto, at the convention of the International Stone Cutters Association at the Hotel Congress, in Chicago, last week.

Roster of A.C.B.C.I. Convention

General Contractors

J. S. C. Adamson, W. G. Adamson, Ottawa.
J. P. Anglin, Anglin-Norcross Ltd., Montreal.
J. B. Carswell, Carswell Construction Co., Toronto.
A. W. Cassidy, A. W. Cassidy & Co., Saskatoon.
W. Stewart Christie, Alex. Christie & Son, Ottawa.
K. D. Church, Church, Ross & Co., Montreal.
G. A. Crain, Ottawa.
W. R. Carr, Contract Record, Toronto
T. E. Turner, Contract Record, Toronto.
W. Milne Crockett, E. T. Construction Co., Sherbrooke
A. H. Dancy, H. N. Dancy & Son Ltd., Toronto.
A. Sidney Davies, Atlas Construction Co. Ltd., Montreal.
F. H. Dickenson, Inland Construction Co., Toronto.
John Flood, John Flood & Sons, St. John, N. B.
John Foley, Ottawa Construction Co., Ottawa.
R. J. Fuller, John V. Gray Construction Co., Toronto.
Jos. Gosselin Jr., Jos. Gosselin Ltd., Quebec.
Hugh Graham, Alex. I. Garvock, Ottawa.
H. T. Hazleton, Hazleton & Wahn, Ltd., Winnipeg.
J. F. Heaney, Lockwood, Green & Co. of Canada Ltd.
F. E. Healy, Pigott-Healy Construction Co., Hamilton.
P. E. James, P. H. Secord & Sons Construction Co. Ltd., Brantford.
A. E. Jennings, Canadian Engineer, Toronto.
Robt. J. Lecky, Robt. J. Lecky, Regina.
Sir F. O. W. Loomis, D. G. Loomis & Son, Montreal.
D. H. Lunam, Poole Construction Co. Ltd., Regina.
E. A. Markham, Poole Construction Co. Ltd., Regina.
Jos. F. Meagher, Ross, Meagher Co., Ottawa.
D. McArthur, McArthur Bros., Ottawa.
R. McArthur, McArthur Bros., Ottawa.
Thos. McLaughlin, T. McLaughlin, Ottawa.
Norman McLeod, Norman McLeod Ltd., Toronto.
Joseph M. Pigott, Pigott-Healy Construction Co., Hamilton.
J. E. Poirier, J. E. Poirier, Ottawa.
S. Pritchard, S. Pritchard, Moose Jaw.
Jno. Putherford, J. Putherford, London.
S. F. Smith, S. F. Smith, Ottawa.
J. A. Strumbert, D. G. Loomis & Sons, Montreal.
J. C. K. Stuart, Stuart & Sinclair, Hamilton.
J. K. Thomas, Thomas-Jamieson-McKenzie Ltd., Calgary.
David K. Trotter, Builders' Exchange, Montreal.
Wm. Wilson, Wilson & Wilson, Ltd., Regina.
W. H. Yates, W. H. Yates Construction Co. Ltd., Hamilton.

Sub Contractors

P. Ackroyd, Electrician, Ottawa.
H. L. Allen, Electrician, Ottawa.
W. E. Dillon, W. E. Dillon Co. Ltd., Toronto.
R. Hooper, Hooper Bros., Ottawa.
J. W. A. Kirk, Ottawa Cut Stone Co., Ottawa.
W. A. Mattice, Dominion Bridge Co., Ottawa.
James Mackie, James Mackie Co. Ltd., Winnipeg.
Wm. McInenly, Mac Electrical Co., Ottawa.
W. J. Nicholson, National Fireproofing Co. of Canada Ltd., Toronto.
R. K. Palmer, Hamilton Bridge Works Co. Ltd., Hamilton.
Jas. Phinnemore, Painter, Toronto.
James Ritchie, Cut Stone, Ottawa.
E. D. Spence, Contractor, Ottawa.
W. N. Talbot, W. N. Talbot Co. Ltd., Regina.

Supply Dealers

J. C. Adams, Canada Cement Co., Toronto.
Fred Armstrong, Port Hope Sanitary Mfg. Co., Toronto.
Ernest M. Barrett, Barrett Bros., Ottawa.
W. P. Baxter, James Robertson Co. Ltd., Montreal.
W. C. Beattie, Public School Board, Ottawa.
W. W. Cuzner, Cuzner Hardware Co., Ottawa.
A. J. Dickey, C. A. Dunham Co. Ltd., Toronto.
A. A. Dion, Ottawa Electric Co., Ottawa.
C. W. Marshall, Can. Agency & Supply Co., Ottawa.
O. Forest, Ottawa Fireproof Specialty Co., Ottawa.
P. A. Galarneau, Citadel Brick Co. Ltd., Quebec.
G. B. Greene, General Supply Co. of Can. Ltd., Ottawa.
T. S. Kirby, T. S. Kirby Co. Ltd., Ottawa.
J. M. G. Crockerby, Alex. McArthur & Co. Ltd., Montreal.
W. C. Massiah, Sherwin-Williams Co. Ltd., Montreal.
W. A. Mattice, Dominion Bridge Co. Ltd., Ottawa.
W. H. McIntyre, Ottawa Gas Co., Ottawa.
W. J. Nicholson, National Fireproofing Co. Ltd., Toronto.
R. K. Palmer, Hamilton Bridge Works Co. Ltd., Hamilton.
Hugh Peel, Pedlar People Ltd., Ottawa.
Ernest Ramus, Builders' Sales Ltd., Ottawa.
W. A. Rankin, Harware Dealer, Ottawa.
C. G. Secord, Brantford Roofing Co. Ltd., Brantford.
J. H. Shaver, C. A. Dunham Co. Ltd., Toronto.
Chas. Smallpiece, Taylor, Forbes Co. Ltd., Montreal.
J. C. G. Stuart, Pedlar People Ltd., Oshawa.
E. Viens, Dept. of Public Works, Ottawa.

J. A. Grant & Co., Limited, Succeeds Grant & Horne, of St. John, N.B.

A new firm, J. A. Grant & Co., Ltd., succeeds the well-known contracting concern, Grant & Horne, of St. John, N. B. The firm of Grant & Horne has been established in St. John for the last four years; during this time they have carried out large and important work including: The McAvity Sheel Plant at St. John; the building of two wooden steamers, 3,000 tons D.W., for the Imperial Munitions Board; wooden schooner for private interests, 1,000 tons D.W.; Fraser Memorial Sunday School, Fredericton, N.B.; Launsbury Building, Moncton, N. B.; extension to Atlantic Sugar Refineries, St. John, N. B.; conveyors for the C.P.R. and Federal Government, and many other works in and around the Province of New Brunswick and Nova Scotia.

Mr. E. G. Horne severed his connection with the firm in July, 1919, to join the firm of Messrs. Lockwood Greene & Company, engineers, Montreal, and and Mr. J. A. Grant has been carrying on the firm of Grant and Horne since that date. Owing to the large amount of new work which the firm has secured and the necessity of expansion, it was decided to form a new company with Mr. J. A. Grant as president and general manager; Mr. James Gilchrist, vice-president and chief engineer, and Mr. William Neish, secretary-treasurer.

The Ball Engine Co., Erie, Pa., builders of the Erie shovel, have just issued a very attractive calendar for the year 1920. On each sheet are phographs showing Erie shovels at work under all sorts of conditions, with statements from contractors all over the continent testifying to the character of service the Erie has rendered them. Copies of the calendar may be obtained by writing the company.

No. 5

Canada's Contractors—A. H. Dancy

Mr. A. H. Dancy, president and manager of H. N. Dancy & Son, Ltd., is one of the best known contractors of Toronto, not only because of the extensive nature of the work carried out by him, but also on account of his efforts in the direction of improving the status of the contracting industry. Mr. Dancy has been very active in all matters relating to the uplifting of contracting and has given considerable of his time toward furthering the principles of organization.

He is a Torontonian by birth. After passing through the public school he started in to learn the mason branch of building construction with the firm of Dancy Bros., masons and plasterers, of which concern his father was the senior member. After spending a number of years gaining a practical knowledge, he was admitted into partnership in the year 1897. He continued in active superintendence work until in 1904 he began to devote himself to the estimating and accounting department, for which his natural inclinations had led him to qualify. In 1908 the original firm, established then for 25 years, was dissolved and Mr. Dancy with his father carried on the business under the firm name of H. N. Dancy & Son, later H. N. Dancy & Son, Limited, mason contractors. Mr. Dancy was secretary-treasurer of this firm until the death of his father in 1916, when he became president and manager.

This company has carried on a varied and extensive business and the work executed by them includes many of the well known buildings of Toronto, among which are the Empire building, erected on the site where the great fire of 1904 had its origin; main office building of the O'Keefe Brewery Co.; Oak Hall, the 10-storey walls of which were built in 11 weeks; six-storey building of Willard's Chocolates, Limited, on which a construction record for this type of building was attained; administration wing, Toronto General Hospital; administration building of the Board of Education; Knox College; Dovercourt and Wychwood public libraries; Westminster hotel; Aged Women's Home; Church of St. Mary the Virgin; many well known banks and a number of high class residences.

In recent years Mr. Dancy has given considerable attention to local, provincial and Dominion organization work in the building industry. He was the first honorary-secretary of the Association of Canadian Building & Construction Industries, organized at Ottawa in November, 1918. In 1919 he was president of the Master Masons' Section of the Toronto Builders' Exchange and was also vice-president and director of the last named body. Mr. Dancy has given serious consideration to problems relating to employers and employees and is strongly convinced that most of the barriers now separating these classes can be effectually removed if the questions are approached with unbiased minds and with a true appreciation of the absolute dependence of each on the other. In this connection he served with other representatives of the Canadian Building industry at the Industrial Conference with the Minister of Labor at Ottawa in September last. Although Mr. Dancy entered business life directly from public school, he realizes that under present day conditions especially, the lack of more advanced education than such a course can provide is a serious handicap to successful business. From his own experience, he is convinced that the thoroughly qualified contractor requires to combine the knowledge gained by practical experience on the work with the educational training of the technical schools and urges such education for all young men who intend identifying themselves with the building industry.

Mr. A. H. Dancy

Leaside Engineering Co., Limited, Leaside, Ontario, has organized a contracting department, and is prepared to enter into contracts covering the construction of pulp and paper mill plants, hydro-electric power development, industrial plants, factories, warehouses, bridges, wharfs, etc. The company's organization in the past has constructed a large shell plant consisting of 6 buildings for the United States Government; wire plant for Canada Wire and Cable Co., Ltd.; tire mill for Dominion Tire Co. at Kitchener, Ont.; complete sets of railway and locomotive shops at Moncton, N. B., Halifax and Charlottetown, P.E.I.; 10,000 h.p. hydro-electric plant at Cobalt, Ont. for British Canadian Power Co.; 20,000 h.p. hydro-electric plant at Beaupre, Que. for Laurentian Power Co.; besides a large number of smaller contracts. The company will be represented by Edward C. Warren as manager, and J. R. Nichols as general superintendent, both of whom have been in the organization for a number of years and have handled the above mentioned undertakings.

In connection with the colonization policy of the Quebec Government, it is intended to spend five million dollars for the purpose of opening up districts, the greater portion of which will be on roads and bridges. Communication roads through the forests will also be constructed for the development of timber resources.

Asphalt Association's Publicity Campaign

The publicity campaign launched by the Asphalt Association last fall will be gone ahead with during the present year. Details of the campaign, which will be available for publication later, are being worked out in the parent office of the Association in New York at the present time. The purpose of this work is to educate the public to the possibilities and advantages of asphalt as a construction material. The campaign will cover the whole of the United States and Canada.

Mainly Constructional

East and West—From Coast to Coast

Fire losses in Toronto for the month of January amounted to $731,980.

The report of the Building Department of York Township, Ont., for last month shows 21 building permits issued for a total of $54,250 compared with $44,980 for the month of January, 1919.

A deputation of citizens of Niagara Falls, Ont., headed by Mayor Stephens, waited on the Provincial Secretary recently asking for an additional grant of $500,000 for housing purposes in Niagara Falls.

Value of building permits issued at Windsor, Ont., for the month of January, this year, established a record for one month in the history of the city. The number of permits issued was 31 and value $635,950.

The first annual social gathering of the Technical Engineers,' Architects' and Draughtsmen's Association, of Montreal, was held recently in Norman Hall. An entertainment was provided at which several valuable prizes were given away.

It is announced that the Wood Hydraulic Hoist Co., of Detroit, have purchased five acres of land at Tecumseh Rd. and Marentette St., London, Ont., and will erect a subsidiary plant for the manufacture of their product. It is also stated that the firm will employ in the neighborhood of 1500 men at their proposed plant.

A settlement has been reached between the city of Montreal and the employees of the civic waterworks system and 250 men, who have been idle since Jan. 1, returned to work recently. The settlement was effected at a meeting of the Executive Committee of the Trades and Labor Council and the Civic Administration Commission.

A recent meeting of the Works Committee of the City Council, Toronto, the recommendation of the Works and Assessment Commissioners that Teraulay Street be extended north to Davenport Rd., at a width of 86 ft., was adopted. The estimated cost of this undertaking is $1,250,000, of which sum the city will contribute $553,228, while the balance will be levied upon the properties benefited.

The construction program at Calgary, Alta., this year includes the building of a sewage disposal plant, extension of waterworks system, addition to building equipment at fair grounds, a concrete bridge to connect the city with Hillhurst and the expenditure of $155,000 on additions to hospitals throughout the city. The building of two new schools will also be necessary in the near future.

City Clerk Baker, of London, Ont., has been instructed by the Housing Commission to communicate with similar bodies in Western Ontario with a view to the organization of a federation through which it is believed building materials and other supplies could be more cheaply purchased. The London Commission proposes to build 40 or 50 houses this year, and is anxious to co-operate with commissions elsewhere for the exchange of ideas and the development of housing legislation.

About 200 prominent citizens of Wentworth and Hamilton attended the luncheon held at the Royal Connaught Hotel, Hamilton, recently, in honor of the Minister of Public Works, Hon. F. C. Biggs, who outlined his road building policy for the province of Ontario. A resolution was passed by those present approving of the main features and general policy for the extension of the good roads' system. J. F. Vance, county clerk of Wentworth County, also gave a short history of the county's roads, stating that $1,003,474.70 had been spent in county roads since the inauguration of the good roads system in 1902.

The general contractors of Hamilton have organized under the name of the General Contractors' Association of Hamilton. At a meeting held recently the final details of organization were cleared up and a form of constitution and set of by-laws adopted. The officers elected for the coming year were: W. H. Yates, president; J. W. Frid, vice-president; J. M. Pigott, secretary-treasurer; F. W. Paulin and J. C. Stuart, executive. The new association sent representatives to the Dominion Convention of the Association of Canadian Building & Construction Industries, held recently at Ottawa.

Personal

Mr. William Kirk Thompson, of Toronto, has been appointed engineer clerk, Department of Interior, Ottawa.

Obituary

Mr. M. W. Hogle, of Hogle and Davies, architects, 80 St. Francois Xavier Street, Montreal, died recently in his fiftieth year. He was born in Philippsburg, Quebec.

The death occurred recently of Mr. James Rogers, a veteran railway contractor, of Montreal. Mr. Rogers was born in 1837, and began his career with the Grand Trunk Railway. The first contract he undertook was the building of the Lake Superior division of the Canadian Pacific Railway, as sub-contractor under Mr. R. G. Reid, while he also carried out other contracts for the C. P. R. and other companies.

Trade Incorporations

Sherbrooke Housing Company, with head office at Sherbrooke, Que., capital $90,000,

Aluminum Steel Products, Limited, head office Owen Sound, Ont., capital $250,000.

Point Grey Construction Company, with head office at Vancouver, B. C., capital $25,000.

Foundries, Limited, with head office at Ottawa, capital $24,000, to manufacture iron and steel.

Prnueau & Company, Limited, with head office at Quebec City, capital $90,000, to deal in building materials.

Canadian Electric Steel, Limited, with head office at Montreal, capital $5,000,000, to manufacture steel, iron and metal products.

Canadian Fireclay Products, Limited, head office at Toronto, capital $40,000, to manufacture and deal in articles made from fireclay.

The Lancashire Land & Construction Co. Ltd., with head office at Montreal, capital $20,000, to carry on the business of real estate dealers and general contractors.

ESTABLISHED 1886

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Architects to Urge Use of Canadian Building Materials

SOME of the leading officials of the Ontario Association of Architects have been taking up the question of developing Canadian resources and employing domestic materials for construction purposes. In this connection, the president of the association, Mr. Herbert E. Moore, has addressed a letter to the members of the O. A. A., asking for individual opinions on the matter. As the letter speaks for itself, it is printed herewith in full.

"During the war there was considerable comment and discussion amongst architects concerning the use of imported materials and the employing of professional talent from the United States, in the erection of some of our principal buildings. Since that time, a great deal has happened to further accentuate conditions, namely:—

"1. Rate of currency exchange with the United States, which shows at the present time something like 12 per cent. against our money.

"2. Various warnings by our educational authorities urging the utilization of Canadian brains as well as Canadian material resources.

"3. The effort of the Association of Canadian Building and Construction Industries to ensure the use of Canadian goods, showing that the business interests are alive on this question.

"Time and again architects are asked, 'What are you doing in this matter?' and so far as one can see, very little has been attempted by way of systematic effort. In some cases, individual efforts have been passively looked upon as an outburst of some crank, who either has an axe to grind or has some mistaken idea as to the possibilities of business in its relation to patriotism.

"It would seem that this question has reached a vital point; one where we, as architects, should state our position, and I would therefore ask you for your views, with any suggestions you might have concerning the advisability of placing our Association on record before the Government and the Public, and an answer to the question, 'What are we doing in our practice to develop Canadian resources?' "

Quebec Builders' Association to Overcome House Scarcity

THE Quebec Builders' Association at a special meeting on Feb. 4, discussed the housing plan as suggested by the Federal Government. The meeting was held under the chairmanship of Mr. E. G. Brousseau, president of the association. So far Quebec City has not availed itself of the advantages offered by the law, but it is expected the builders' association will start a movement to benefit by the offer and erect buildings which are badly needed.

There is a marked shortage of dwellings both in Quebec City and the suburbs and the Quebec Builders' Association, by starting work on houses would help to overcome the shortage.

The meeting voted to write the Government for detailed information as to the plans and conditions of loans and the association have invited Dr. Emile Nadeau, chief provincial executive under the housing law, to meet them and explain the operation of the law.

Unusual Method of Bracing in Construction of Halifax Pier

AN unusual method of bracing was employed for the construction of the cylinder foundations of the Withy Steamship pier, Halifax. Each bent of the substructure has four concrete-filled steel cylinders 6 and 7 ft. in diameter and 25 ft. 9 in. and 30 ft. apart on centers. After the cylinders were concreted to a little above low water level holes were cut in the steel shells to receive the ends of the panels of bracing which weighed 12 and 14 tons apiece and were pre-cast in the contractor's yards in advance of erection. Each brace consisted of a pair of 18 x 18-in. heavily reinforced diagonals with a horizontal connecting the lower ends and a short vertical strut projecting upwards from their intersection. The reinforcement bars from all these members projected some distance beyond the concrete and were bent at the ends to afford anchorage and bonding with the concrete in the cylinders and in the pier floor. Up to an elevation 7½ ft. above low water the braces were permanently sheathed with 3-in. of timber in two thicknesses, the outer thickness creosoted to afford protection against frost and ice.

Joint Action Needed to Improve Engineer's Status

Retiring President of Engineers' Club of Toronto Urges Cooperation in the Profession

THE need of joint action and unity of purpose among engineers and the benefits resulting from such co-operative effort was the outstanding theme of the valedictory address of Mr. J. R. W. Ambrose, retiring president of the Engineers' Club of Toronto, at the annual meeting at the club's headquarters, 96 King St. West, on Thursday, February 5. While the status of the engineer formed the main topic, Mr. Ambrose, as is usual in such addresses, reviewed the progress of the club's activities during his tenure of office. The year 1919, he pointed out, was one of success and expansion so far as the club was concerned. The membership had grown consistently until a stage had been reached where a waiting list would soon have to be established. In nine years, according to Mr. Ambrose, the resident membership had increased from 300 to 500 and the non-resident membership from 70 to 150, and, at the present time, a considerable number of applications for membership had been received as a result of the club's decision to increase the entrance fees, so that unless a waiting list was determined upon, the club's facilities would soon be taxed. One gratifying feature to which Mr. Ambrose drew attention was that 75 per cent. of the club's members were technical men.

The fostering of all engineering activities was emphasized by Mr. Ambrose as one of the club's purposes. With this end in view, it was willing to cooperate with technical societies and make its facilities available to them. The library, one of the big assets of the club, was a feature that technical non-members had taken advantage of, but there had been comparatively little appreciation of it by the club-membership.

Expansion is Expected

Financially, the club was sound. It was not its aim, of course, to be a money making organization, as it was operated for the mutual benefit of the members, but its books closed in 1919 with a gratifying balance on the right side; this in spite of the fact that fees and charges were lower than most other clubs in Toronto. As it had suffered no set-back during the war but had been flourishing consistently, it was Mr. Ambrose's confident expectation that this progress would so continue that by the time the lease on the present premises expired, the club would be able to build its own quarters.

Mr. Ambrose welcomed back the soldier members of the club who had returned and paid solemn tribute to those who had proved their devotion to the principle of right and justice by their sacrifice on the field of battle.

In developing the main topic of his address—the status of the engineer—Mr. Ambrose reminded his audience of the part that engineers have played in world development and affairs. The public had been slow in giving the rightful credit to the engineer and even among engineers themselves there were not many who realized the importance of their calling and the contribution they had given to the upbuilding of Canada and the world in general. Behind every source of our country's wealth, except, possibly, agriculture—and even behind that to some extent—was the engineer, but in spite of this influential position at the very foundation of our economic development, he was content to rest unnoticed and unrewarded. In citing examples of the part that engineers played, Mr. Ambrose, as a railroader, naturally drew on the railroads for his illustrations and he paid tribute to the work of the engineers that made possible the extension of those pioneer lines through the West amid tremendous difficulties. The railroads, however, were not alone in furnishing examples of the role of the engineer as a benefactor of mankind—in a multitnde of other industries and lines of activity, the engineer was faithfully performing his own duty and contributing his share. For this did he reap his just reward? No; in spite of all this, he stood aside and let some ward politician take the credit.

Engineers Responsible for Large Expenditures

Engineers are trustees, declared Mr. Ambrose, for the vast amount of invested capital in our industries and for the millions spent annually in their maintenance and improvement. Take the railroads as an example. With one billion dollars invested in Canada and forty millions expended annually on maintenance, engineers had a tremendous responsibility on their shoulders—a responsibility that should guarantee them a higher place in the economic life of the country and a greater reward than they have in the past been accustomed and, indeed, willing to receive. When these many millions of dollars were augmented by the vast expenditure of the municipalities, the province and the Dominion, the hydro-electric enterprises, the industries, the mines, and other users of engineering service—an expenditure for the sane investment of which engineers are almost wholly responsible—it is evident that they are carrying a big burden ridiculously out of proportion to the meagre position they have attained in the eyes of the public.

A billion dollars was the amount estimated by Mr. Ambrose as passing through the hands of engineers in Canada annually. If they received five per cent. of this amount as remuneration, every engineer in Canada would receive $5,000 a year.

Joint Action is Needed

Joint action was Mr. Ambrose's suggested remedy for the ills of the engineering profession. Unity of purpose and co-operation of effort was the method of increasing the prestige of engineers and nothing could be done to increase this prestige, in the opinion of Mr. Ambrose, until they did get together. There was a great deal of debate these days on the subject of legislation as a means of increasing the prestige of the engineering profession, and it was obvious that it very intimately affected the life and living of engineers. However before legislation must come some measure of co-operation.

Engineers have been asking for public recognition, they have been taking the public to task for not recognizing them, but they have made no effort to get

No. 11

Canada's Engineers—W. G. Swan

In appointing Major William George Swan to the position of Chief Engineer of the Vancouver Harbor Board, the commissioners have selected a man, the greater portion of whose engineering experience has been gained in British Columbia, where he has been connected largely with railroad development. In the practice of his profession he has had a varied experience that specially fits him for the class of work that will engage his attention in his new sphere of activity. Mr. Swan is a graduate of the Faculty of Applied Science of the University of Toronto, with the degrees of B.A.Sc. and C. E. For two years he was on the staff of his alma mater as demonstrator and lecturer on mechanics of building materials. In 1903 he acted as assistant hydrographic engineer for the Dominion Government, and, in the following year he entered the service of the Canadian Northern Railway. While with this company he served in turn as resident, bridge, divisional, terminal and district engineer, with headquarters in New Westminster. In addition to his general railway construction experience, Mr. Swan was for three years in charge of the construction of the Pacific Coast mainland terminals of the C. N. R. He also designed and superintended the construction of the Port Mann wharves and was in charge of the reclamation of False Creek Mud Flats for railway terminals. Mr. Swan has to his credit three and a half years of military service; two years and three months of which were spent in France, where he was a major in a railway construction battalion. When war broke out he was an officer in the 104th Westminster Fusiliers, and he took an active part in the formation of the 131st battalion, with which unit he went overseas.

Major W. G. Swan

He won the Distinguished Service Order and the French Croix de Guerre. Mr. Swan is a member of the Engineering Institute of Canada.

together and thereby get the recognition they demand. Engineers must bring themselves before the public, must accept public office, must be ready to help the public, must serve the public without thought of self. This stand, brought about only by co-operation, will win for the profession the status it deserves and desires. As soon as engineers give something to the public, just so soon will the public be willing to give them their rightful dues. Co-operation and unity was Mr. Ambrose's only hope for the engineer. That alone would win him prestige. As the speaker stated, "If each engineer will exert some fraternal spirit, he will receive his fair share of the benefits of life."

Officers Elected by Engineers' Club

The following officers were elected for 1920:—President, Mr. Melville P. White; 1st vice-president, Tracy D. LeMay; 2nd vice-president, J. B. Carswell; 3rd vice-president, W. R. McRae. Directors—J. R. W. Ambrose, A. B. Cooper, E. G. Hewson, Charles H. Heys, Arthur H. Hull, J. H. McKnight, L. V. Rorke, J. R. W. Wainwright, Walter F. Wright, Major E. W. Wright and T. S. Young; Secretary-treasurer, R. B. Wolsey.

A free scholarship, covering four years' tuition in architecture, chemistry, civil, mechanical or electrical engineering at McGill University, has been offered by the Canadian Pacific Railway, subject to competitive examination, to apprentices and other employees enrolled on the permanent staff of the company, under 21 years of age, and to minor sons of employees.

Prizes for Mount Royal Houses

Awards have been made in an architectural competition for designs for residences to be erected in the town of Mount Royal during the present year. Four prizes of $150 each were offered by the Model City Housing Company, for designs for detached and semi-detached residences, two of each type. Sixty-seven designs were sent in. The designs were judged by a committee of the board of the company, together with Mr. David R. Brown and Mr. J. E. Wilder. The prizes were awarded to the following designs: Detached eight-room house, C. R. Tetley and S. D. Ritchie, Montreal; semi-detached eight-room house, A. D. Thacker, Montreal; detached six-room house, W. L. Somerville, Toronto; semi-detached six-room, H. M. Patterson, Montreal. The prize-winning designs will be used, together with others, for the fifty to one hundred houses which the company proposes building this year.

The extensive additional powers given to the Quebec Public Service Commission,—the new name of the Public Utilities Commission,—will, in one way, affect engineers and other experts who are concerned in acting on expropriation and arbitration boards. Under the new Bill this work will be done by the commission, who will not make a charge for the services rendered, but the Lieutenant-Governor in Council has the right to charge a certain tariff to cover the expenses of the Commission.

Ontario Builders and Supply Men at Enthusiastic Conference Seek to Elevate Status of the Construction Industry

At Eighth Annual Convention of the Provincial Builders' and Supply Association, Contractors' Problems are Discussed and Remedies and Improvements Suggested

THE Eighth Annual Convention of the Provincial Builders' and Supply Association opened on Tuesday afternoon, February 10, in the King Edward Hotel, Toronto, with the President, Mr. H. Elgie, in the chair. There were two addresses of welcome delivered—one by Mr. J. C. Scott, on behalf of the Toronto Builders' Exchange, and the other by Controller Maguire, on behalf of the city of Toronto. Both Mr. C. Blake Jackson, the President of the Builders' Exchange, and Mayor Church, were to have been present, but were unable to attend on account of illness. Their "proxies," however, did the honors in a very graceful and acceptable manner.

The minutes of last year's convention were read by the secretary, Mr. T. R. Wright, and the auditor's report, presented by Mr. Geo. Gander. These were approved. Mr. Elgie then made his presidential address, which follows, practically in full:

Vast Opportunities in the Contracting Business—Address by President Elgie

Gentlemen of the Convention:

It is with the greatest of pleasure that I meet with you to-day. A year ago you forcibly conscripted me and placed me in the chair as your president—a British subject, however, will obey the people of the country that he loves, whether conscript or otherwise.

Now you need not thank your president for any work that has been done. I may have written and sent several hundred letters and dodgers to all of the contractors and supply men throughout the cities and towns of the Province of Ontario, but, I want you to know that Mr. Wright has spared no time nor trouble for the Provincial and your executive—Mr. Dillon on the Lien Law, Mr. Gander on the Compensation Act, and all the others were Johnnie-on-the-Spot every time. I must not forget the Contract Record, they have rendered a very valuable service—Major Reynolds, Dr. Carr and Mr. Turner deserve your very great thanks.

I take it that we are here to do business that we owe to ourselves. There never was a time when I felt more intimately concerned with the problem than I do to-day at this convention of my fellow craftsmen. I am not one of the men that embarked in the contracting business without having had practical experience, because I spent a score of years of my life with a trowel in my hand and overalls on and that brings a man closer to this subject than anything else. The actual performance of the work gives one a real ready knowledge of the business.

I think contracting gives greater opportunities than any other business that you can find, and yet it is subject to the greatest number of abuses. You men are being imposed on more than men in any other business or industry. If you can establish in your organization a proper method for the transaction of business for contractors you are going to leave a legacy that will be worth more to your successors than millions of dollars, because, you put your business on the footing where it belongs. Do you know that the contracting business is the second largest industry in the Dominion? And yet, you have not secured the status you should have in the community. You do not take a stand and satisfy yourselves that you hold a proper place in the public estimation. Some of you contractors let the general contractor peddle your bids and you bite, or again you will try to find out your competitor's bid and under-bid him again. Now, neither of you is honest and you know it. You cannot do a wrong to your fellow contractor without doing a wrong to your industry and the community which you live in. This is one of the very bad abuses which I hope you will be able to remedy.

A Higher Standard

I hope, by an exchange of thoughts, ideas and views in a convention of this kind, you will bring about a better condition and that the delegates that are here when they go back to their home town or city will preach to their membership the importance of their own business. Look upon yourselves as equal to the steel magnate, manufacturer or merchant. If you would consider yourselves his equal mentally you would become so financially. If you will make yourselves believe, and properly so, that you have a right to transact your business in the same manner that the banker or the lawyer does, then you will succeed. If you can bring that home to the minds of your own people you need not indulge in anything dishonest or illegal in order to gain success. The country is opposed to malpractice and you are, and so am I. I am against combinations. I do not believe it is right or honest for a class of men to get together and frame up a combination and fix a price on a job because they have it under their control; that is morally wrong. But I do think that every man is entitled to a fair price for his work. We know that when a man is out of a contract he is willing to figure down to almost a starvation point. That is not fair to you nor your competitors, nor to the men you employ. It is a crime against your family, your supply men and your creditors. You are stealing from them. Surely we can attain, through your organization, to a higher standard and a better condition of affairs.

Make Good as a Contractor

Inaugurate a code of ethics or practice in your industry. Deal fairly and honestly with competitors and the public. The men representing your organization must necessarily set that example. You must go back home and establish and work it out yourselves.

Then again a contractor should be a contractor; he should not want to do all the work himself. You think because you can lay more bricks than your men that you are making money. Are you making good as a contractor or just as a journeyman? You can earn that money as a journeyman and only work eight hours a day. As it is, you do a journeyman's job and then go home at night and slave at figures. Are you making good as a contractor? I say **No.** You ought to uphold the dignity of the position. You ought to ensure that you are just as good as any man who sits in his office and dictates the policy of his business. You ought to feel that you are the equal of any other business man.

The Work is Waiting—What is Needed are Proper Methods of Doing it.

I know that we are going to have a better condition of affairs. I know that the demand for your product —and it may be properly called a product—is going to be so great that you will not see the end of it for a number of years. There is no use you deceiving yourselves, or me deceiving myself. They are going to demand houses and factories, churches and institutions all over the country just as fast as you can build them for the next ten years or more. Just stop and consider that there were five years of idleness, practically, and if you will just go along as fast as they can produce the material and the men you will not make up those five years in the next ten years. You don't have to worry about not having enough work. You will have all the work you will need and all you need to do is to direct your business in such a way that you are going to do that work properly so that it will reflect credit upon you, at the same time remembering that you have a standing in the community the same as any other professional or business man.

A Plea for Openness and Fairness

Now will you take what I am going to say in good part because it affects myself the same as it does you. But I say it; we must have better conditions; we want to go forward; we must go forward; we must have more faith in one another. Remember that the other fellow has a lot of good qualities that we have not seen as we should and we have some qualities that we are glad to hide from the other fellow. I want to stop, if I can, this sharpening the pencil on one another. I want you when you send in your estimate to your architects or owner, to stand for that estimate. I want you to trust one another. I want you to make up your minds that in your various associations when your estimates are made, they shall be so figured that you shall receive that which is right for the work; that which is just; that which will give you a fair return for the money you have invested and having written your figures once with the knowledge that they are right and just, that you will not change them for any living soul.

Then, I would like you, to have in your respective cities, an association or executive officer who shall receive from you sealed copies of your tenders on each job and shall make these tenders known to each of the bidders on a specified day, after which no other bid shall be submitted.

Stability of Prices

I would also like to see the Exchange as a whole have one set fee for dues, but the different sections be changed, say, ¼ of 1% of pay roll taken from the same pay sheets or time book that is given to the Compensation board. Further I would suggest that a committee of supply men get together and discuss the possibility of stabilizing prices for eight or twelve months ahead so that it will be possible for a contractor to give some kind of an intelligent estimate. I have a feeling that this should be a great benefit. We must realize that we are Canadians and citizens of the Province of Ontario and other Provinces before we were contractors or supply men and we must consider the greatest good for this fair Canada of ours. Its future depends on the men of to-day.

Advice to Committees

I would greatly appreciate it if the chairman of each Committee would select his numbers as geographically as possible, so as to have the several districts represented.

The Joint Industrial Committee should carefully and seriously consider the advisability of recommending a council to be organized in every town and city in the province. Also recommend it to be encouraged by the Government as to settle differences that arise from time to time between employers and employees and to further the interest that is common to both.

Mr. H. Elgie, retiring President of the Provincial Builders' and Supply Ass'n.

I have no doubt that Mr. E. R. Dennis will bring in a valuable resolution on Technical Education and Apprenticeship as this is the most vital subject pertaining to our industry, and if some action is not taken in the near future the building trades will be retarded beyond recovery.

Universal Building By-laws

In dealing with this subject it has been brought to our notice that several towns and cities in the province are very lax in their building by-laws and some of the smaller places have no building by-laws whatever, and buildings have been erected and are, no doubt, dangerous to life. I am of the opinion that this matter should be brought before the Provincial Government. The International Agreement Committee will find that they have a very important subject to deal with as we in Ontario have been greatly affected in the past by not having some understanding with our cities and towns in Canada and United States in regard to hours of labor and wages.

We have a very able chairman of the Organization and Membership Committee in Mr. P. L. Fraser. Through his long experience as an organizer and Secretary of our Association he is alive to the fact that the work of his Committee means the future life and success of our organization, and I hope they will devise some means of reaching the contractors in districts where no Exchange exists and also consider new by-laws.

If the convenors of Legal Affairs and Lien Law Committees care to get together it might be possible to satisfactorily group the two and embody the petitions of both in one resolution.

Mr. Gander has done good work in protecting our interests in opposing drastic amendments to the Compensation Act and has watched every movement of the Board since its formation. I am sure his Committee will give us a report which will be of great value to us. I know we would all like to hear a report of the good work he has done, as well as having a separate resolution recommending any improvements that his Committee deem wise.

The Code of Ethics is also a very important subject and is prized very dearly among the builders and contractors throughout the United States.

* * *

Mr. Geo. Crain, of Ottawa, declared that the President's address had brought out a number of very important points, which should receive the consideration of the convention, and he moved that it should be referred to a committee for some definite action.

Mr. W. E. Dillon, of Toronto, seconded the motion, and Messrs. Gibbs, Gibson, Dillon and Graham, were appointed as a committee to take up the various points touched upon in the address and bring in a report.

Activities of Local Exchanges — Chatham, London, Ottawa, Sault Ste. Marie, Toronto, Sarnia, Hamilton

Representatives from the various towns and cities were then called upon to report regarding the activities of their local exchanges and conditions in the trade generally.

The Chatham exchange reported that they had about eighteen members in good standing and that they were doing their best to increase the number.

Mr. L. A. Boss, from London, stated that while the activities of the London Builders' Exchange for 1919 were not as encouraging as might be desired, still, it was shown that they were continually making progress along safe lines. Proceeding, Mr. Ross said:

"Organization has been the keynote of the London Exchange since its inception, and although the responses to its many appeals for a getting together movement amongst the members of all lines of building industry have so far been disappointing, still we look for a full harvest in the near future.

"A number of our members are of the opinion—and I think rightly so—that the only way to accomplish our aims is by the appointing of a permanent officer, who will be capable of managing the business of the different trade sections, as well as of the corporation, and who will be able to devote all his spare time to organizing trade groups or canvassing for new members. This would necessitate ample financial resources, such as can only be obtained when our contractors agree to provide for them in their estimates.

Public Best Served by United Building Industry

"We think that this is a question well within the province of the Provincial Association to discuss, and advise all local organizations upon, for the general public will be best served when all the building interests of this country are united in one association and all governed by just and equitable rules.

"As regards building conditions in London during the past year, I suppose they have been similar to all other centres. Materials fluctuating in price every few days. Transportation facilities rotten. And as to wage agreements with the unions, they were merely scraps of paper, utterly ignored.

"Right here is another question that might be entrusted to a committee of this convention to consider and advise upon—that is, the standardizing of wages throughout the province. As we cannot compel the labor organizations to be incorporated, and consequently can obtain no redress for any violation of an agreement, we should be protected by having wages standardized, as then there would be no object in men leaving one centre for another.

"Another matter that our Directors thought should receive attention from the Provincial Association is the supervision of locally-made fire doors. Our contractors, when needing such, have to secure them from only one factory, as they are the only ones that are able to put on the Chicago label that the Fire Underwriters demand. Why not have a local inspector in each centre who shall be supplied with the Underwriters' specifications and be able to put the label on any door, locally made, that comes up to the requirements of their board.

"We are pleased to report that the harmonious and pleasant relationships existing between the London contractors and the Guild of Architects during the past years are still maintained. Any matters needing adjustment always receive any attention necessary to avert friction.

Abundance of Work in Sight

"In our Western district of Ontario, the prospects of a large amount of building work are far more in evidence than an abundance of supplies, and although we would not restrict the exporting of those materials that we so much need here, to the war devastated areas overseas, still we would urge that the manufacturing plants for the production of lumber, brick, cements, steel, etc., be greatly increased so that all our demands may be promptly met.

"During 1919, contracts to the amount of $1,500,000 were carried out by our members in London, and about $1,000,000 by outside firms.

"Our entertainment committee has nobly looked after the social end of our season's activities and all our functions have passed off successfully."

Underwriters' Approval of Fire Doors

In reference to securing the Underwriters' approval of fire-doors, Mr. W. E. Dillon pointed out that the Underwriters would send an inspector to any point in the province to place their label on doors meeting their requirements. There was, however, much trouble and expense in connection with new inventions and devices, as these had to be sent to Chicago at considerable outlay in order to be examined and approved by the Underwriters. He thought that either the Dominion or Provincial Government should take the matter up and establish facilities on this side of the line for testing new devices.

Ottawa Contractors Going Strong

Mr. Geo. Crain spoke as representing the Ottawa Association. It gave him great pleasure to be present again at a provincial convention, but, in the first place, he thought it was due to his own association to make clear their position with reference to the provincial organization, as there seemed to have been some misunderstanding. They had been out of business altogether for the last three or four years, due to war conditions. A year ago last November they had talked over the matter of forming a branch of the national association, but took no action at that time. Later, when they were forced to deal with labor collectively, it became absolutely necessary for them to get together. A meeting was held, to which Mr. J. P. Anglin, president of the A.C.B.C.I., was invited, and the Ottawa branch of the A.C.B.C.I. was formed. This step seemed absolutely necessary. Their old Exchange had failed, and in order to bring the better element into their organization they had to organize along broader lines. Twenty-five men came together and appointed a small executive, which was instrumental in settling labor troubles. In order to finance the association, they had every man guarantee $50. Some fifty agreed to this. They then appointed a young man as secretary, who was on the job all the time in a very fine suite of rooms. As a result of their action, the association was in a stronger position than ever before, and they were going to make their influence felt.

The board of trade, which had reorganized, has asked them to appoint one of their members to the board, and in any question affecting their interests that might come before the board, they had their representation to deal with it.

Amicable Settlement of Labor Troubles

In regard to labor, the Ottawa Association had cooperated with the labor unions in forming a Joint Industrial Council, similar to that operating in Toronto. This consisted of five representatives from the unions and five from the association, and its activities had been of immense benefit. Many questions, which might have led to strikes and ill-feeling, had been threshed out by the council and settled amicably.

At the present time they were dealing with questions of wages for the coming year, and they had come to the provincial convention to get information that might assist them.

As far as business was concerned, Ottawa was in a fairly good position. About half their mechanics had left, however, with the result that work had been delayed. In view of this situation, they felt that some action should be taken towards the stabilization of wages. While on board the train they had been told that the labor men themselves intended to take some steps toward this end.

Mr. Crain also spoke in regard to the A.C.B.C.I., as honorary secretary of that organization. He pointed out that the 1918 convention had only been for the purpose of getting together and seeing what could be done, but at the last conference the constitution had been finally adopted. The idea was not in any sense to force out the provincial organization —they felt in Ottawa that there had been more benefit from the provincial association than any other. He believed that the new national association, in its present form of organization, would appeal to every man present.

Conditions in Sault Ste. Marie

Mr. Peter McLarty, of McLarty Bros., general contractors, reported regarding conditions in Sault Ste. Marie. As far as the builders' exchange there was concerned, he declared it was too young to say much about. They had just organized in April of last year, when conditions had practically compelled them to get together. Twelve or thirteen men came in in the spring, and considerable benefit was apparent as a result. During the last three months the activities of the exchange were particularly successful. A number had formed an agreement that there would be no bidding against one another and that their business should be carried out on a cost-plus basis. The architects had been notified and they seemed quite well satisfied with the scheme.

Trade conditions were very good. There was the new courthouse under way, which involved an expenditure of some $300,000; also a technical school, costing in the neighborhood of $200,000, and three other schools, some $100,000. Their greatest difficulty was to get skilled labor.

Cost-Plus Contract Adopted by Soo Contractors

The cost-plus form of contract had been adopted by the principal contractors of Sault Ste. Marie, owing to the continually advancing costs and the practical impossibility of having them guaranteed. Generally speaking, 15 per cent. was added to the cost of the work. As a protection to owner and contractor alike, it was provided that if the contractor was able to effect any saving over the estimated cost, 75 per cent. should go to the owner and the remaining 25 per cent. to the contractor; and on the other hand, if there were any excess over the estimate, the owner bore 75 per cent. of it and th contractor 25 per cent.

Mr. F. E. Ingram, general contractor, spoke as representing the building interests of Stratford. Their exchange in that city was in very good condition at present, and was better off both in numbers and finances than it had been for some time. Considerable work was showing up, and it looked as if this was going to be a good year. A number of new industries were coming in, including the Northern Electric Co. and the Simmon Bed Co. They also needed a lot of houses and expected to build quite a number this season. The only difficulty was the material and labor situation.

Mr. David J. Davidge, secretary of the Toronto Builders' Exchange, gave a review of the activities of this exchange, which indicated considerable progress and increased prosperity. (This review appeared in the report of Toronto Builders' Exchange Annual Meeting in issue of Jan. 28).

New Building Code in Sarnia

Mr. Norris E. Gibb, marine contractor, spoke for Sarnia. The exchange in that city, he said, was on a much healthier basis, both numerically and financially, than it had been for some time. Carpenters' and plumbers' sections had recently been formed, and a plumbers' section was just being completed. There was no building by-law in force at the present time, but one was in course of preparation, and as soon as it was ready for criticism, the Builders' Exchange were to have it for one week for consideration before its final submission. The old building by-law, which had previously been in use, was now entirely obsolete.

Conditions in the building industry in Sarnia had been very good. Last year the local contractors had constructed 242 houses—while the assessment growth only demanded 150, so that Sarnia's needs in the way of housing accommodation were well provided for, unless the steel company would require a large number of houses for new employees.

There were twenty-two members in their Exchange. All the supply firms and all the electricians were members, besides eleven carpenters and four plumbers.

In Sarnia the wages of the workmen were controlled by the rates in Detroit, and for this reason, the speaker thought that if there were any action taken in the matter of standardizing wages, it would have to be in zones.

General Contractors of Hamilton Get Together

Mr. J. W. Frid, of the Frid Construction Co., general contractors, reported regarding conditions in Hamilton. During the past year an organization had been brought into existence in that city, which was, however, composed largely of general contractors at the present time. The contractors had been playing hide and seek with one another and had, in effect, donated $50,000 or $100,000 to the men. Finally, for self-preservation they had come together. Some thought the contractors would not be able to stick together on the maintenance of the wage rate, but the speaker believed they could.

Hamilton, Mr. Frid said, had been somewhat lax in the past, but they would be heard from in the future. The point that concerned them most at the present time was the conservation of the profits now in sight, and in order to do this, it seemed that the cost-plus system of contracting must be adopted.

Mr. Crain, speaking regarding the maintenance of the wage rate, declared that with a strong organization it was quite possible to hold together on the rate agreed. In Ottawa one concern had raised the wages 5c an hour, but the matter was taken up with them by the local association, and they dropped their rates again to the original level.

Mr. J. Bogue, general contractor, of Peterboro, said they had no exchange in his city, though there were a number of abuses prevalent which an organiztion would help to remedy. They had suffered with outside contractors coming in and raising the wage rates and also with workmen moving away to other points where higher wages were offered.

Mr. T. R. Wright congratulated the Soo on their organization and wished there were more exchanges like theirs. They had been very prompt in reply to his invitation and were well represented at the convention.

Mr. Wright emphasized the importance of getting out the report of monthly wage rates. He pointed out that the incoming secretary should send out forms to each city in the province in May and October, and urged that the members should be very prompt in filling them out and returning them.

Standardization of Wages

Mr. Crain said it seemed almost imperative that some action should be taken with regard to the standardization of wages—that was one reason why the Ottawa delegates had been so anxious to come to the provincial convention. The only feasible way to handle the matter appeared to be by dividing the province into zones. Various sections of Ontario were affected by conditions in other provinces and across the border. Two firms in Ottawa had been outbid on a large marble contract in that city by two Montreal firms, which were able to figure their labor costs at a smaller figure due to lower wages rates demanded by the French-Canadian unions. This matter had been brought before the Joint Industrial Council in Ottawa and they had agreed to call off carpenters, steamfitters and other classes of labor, unless the Montreal marble contractor would pay the same rates as were prevalent in Ottawa. The labor men on the council had always lived up to their agreements with the employers, Mr. Crain said. He moved that a committee be appointed to consider the matter of wage standardization.

Mr. Gibbs seconded the motion. He also suggested that it should be possible to standardize the work. The unions said a certain standard of wages must be established. Why should not the contractors demand that a certain standard of work be given in return?

Agreed Wage Does Not Hold

Mr. R. G. Wilson, of R. G. Wilson & Son, general contractors, London, stated that in his city they had started off with 65 cents as the agreed wage rate last season, but that they were now paying as high as $1.10. This condition had been brought about mainly owing to outside contractors coming in and doing work on a percentage basis. He did not see why the employers could not get together and when an agreement was made, force the men to work for no one who did not belong to their association, and who did not pay the rate agreed upon. There should also be something done along the line of standardization, as many of the men were moving to other cities.

Mr. Ed. Charters, of Sault. Ste. Marie, pointed out that in any scheme of standardization special consideration wauld have to be given points such as Sault Ste Marie, where the season was short, and they had competition for labor from the other side of the line.

Mr. Elgie drew attention to the fact that in New York the arrangement was that the mechanic who worked the least number of hours got the highest wages. He thought the same principle should be operative in Ontario, so that if mechanics in Sault Ste. Marie worked a smaller number of hours during the season, they should be better paid.

On motion of Mr. C. F. Till, the following were appointed as a committee to consider the question of wage standardization: Geo. A. Crain, Thos. Bier, N. E. Gibb, Ed. Charters, Robt. Marson, Geo. Gander, J. M. Piggott, J. Bogue.

Protection on Uncompleted Contracts

Mr. Ingram, of Stratford, thought there should be some way of protecting a contractor with an uncompleted contract when an increased scale of wages was demanded.

Mr. Wright did not think it possible to hold the unions to anything until they were made chartered institutions.

Mr. Peter McLarty said he had been a member of an international union for a number of years and that there was a clause in their by-laws providing that for any job under way when a new wage scale was established the labor must be supplied at the old rate, unless the contractor was willing to pay more. In the Soo they had agreed with their men on a rate of $1.15 for the year, and no matter what outside contractor came in, the agreement provided that there should be no change in the rate.

Mr. Elgie pointed out that there were cases where the men lived right up to their agreements even under very adverse circumstances. In Indianapolis, Ind., for example, they continued to work for 90 cents an hour, while all the surrounding towns were paying higher rates. Seeing their loyalty, the contractors had voluntarily raised the wages. In Toronto this year the masons' section had signed an agreement with the men for a rate of $1.00 per hour from April 1. They had come to the conclusion that this was a sufficiently high rate so that they would not be induced to leave the city.

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The Banquet

A very enjoyable banquet was held on Tuesday evening. Mr. Fred Armstrong was in the chair, and among the speakers were Dr. Merchant, director of Technical Education for the Province, Mr. Clapperton, of the Plumbers' & Steamfitters' Association, Mr. A. Frank Wickson, president of the Royal Architectural Institute of Canada, Mr. Shepherd, vice-president of the Ontario Association of Architects, and Rev. A. Logan Geggie. The speech-making was interspersed with enjoyable musical numbers.

After proposing the toast to the King, Mr. Armstrong extended, on behalf of the city of Toronto, a right royal welcome to the guests from other towns and cities. He endeavored to impress upon those present the high responsibilities of their association, and the important place their industry held in their community. There was no industry in the world, he pointed out, which used the products of inventive genius to the same extent. Bureaus of scientific research were continually at work testing strains and stresses of structural materials, and that some of the best laboratories in the world devoted their energies to such problems as heat loss, through walls and windows, and so on. It was not too much to say that at least half of the population of a country was connected directly or indirectly with the building industry. In short, the building game was the greatest game on earth.

Technical Education—Dr. Merchants' Address

"We in the Department of Education have certain interests in common with you men of the building industry," said Dr. Merchant. "One of the urgent demands at the present time is for production. I go to a building which is being erected and on which the endeavor is being made to speed up the work, and I am told that the chief drawback is the lack of production of material. I go down to a store and try to buy something for my table, but find the price almost prohibitive, for the same reason. I wish to import something from the United States and I find I have to pay an additional percentage over the cost in U. S. currency, and I am told it is because of the adverse balance of trade. Now, on what does production depend? On the number, the purpose, the knowledge, the skill and the resourcefulness of the workers. We may say it is dependent on material, but the availability of material and its usefulness depend on human effort. We were reminded a few moments ago that the future of our country is to a large extent dependent on our industries and upon those engaged in them. We have two great fundamental resources—first, on the material side, our large mineral areas, vast water reaches and limitless forests, and, secondly, on the human side, we have the possibilities that lie latent in our children. In both of these cases our resources are as yet potential. We have never realized them to the full. What our children will accomplish will depend to a great extent on the educational agencies that assist them to develop their talents. The real resources then to supply the worker of the country are the children in our schools and our homes. Your work, therefore, is very closely coupled with mine. It may be said that we must import more workers. That may be true—but it should not be. We should develop in our own

Mr. R. Marson, President for 1920 of Provincial Builders' and Supply Ass'n.

schools the workers for our industries and it is your business and mine to do it.

No Training in the Factories

"The time was when they received training in the factories, and that method of training had decided advantages, but it has passed away. The young lad of the present day demands full payment for his services. I was in a plumbing class not long ago and the instructor told me that not one of the boys had ever had an iron in his hand to do a piece of work. Each boy was used to the best advantage of his employers at the time, and the shop was not organized to give instruction.

"We must make adequate provision for instruction throughout the province. You know the old line of education led away from the industries. The training of the schools was all for the professions and for commercial life, and the industries were supplied with boys who dropped out before their education was completed. The fundamental purpose we have in view in the newer form is to direct a much larger proportion of bright young boys and girls into industry, and to give them in these schools a fundamental training that will fit them for it. I mean by a fundamental training, first, a good common school education. One of the weaknesses of industry is that it has been recruited from classes that have not received a good common school education. What we are endeavoring to do is to insure that each boy will be kept at school long enough to obtain a fair common school education, and then that he will have fundamental training for industrial life. The time was when a parent had to decide whether it would be an education or a trade for their child. That time has gone by. To be successful in his trade, the boy should know something of the scientific knowledge of the principles of air pressure and the physical relations that bear upon the processes he is engaged in, and the enlightened plumber of the future should have a fair scientific training. I am not referring to a university training, but he should have the principles drilled into him at school experimentally. He should have the principles of mathematical calculation. What we want, as consumers, is more accurate calculations—no guess work about it at all. There is scarcely a trade that has not scientific principles and mathematical data on which it is based. There is hardly a trade, either, in which drawing is not a fundamental, and the boy should have a good sound training in the principles of mechanical practice. I think there is no town in Ontario with a population over 5,000 where there is not established either a day or evening technical school.

N. E. Gibb, 1st Vice-President

Trade School Cannot Replace Shop

"As regards the trade school, I am not here as an exponent of it. I have seen the best in existence, and I have not yet seen one that can do for a man what a practical shop training will do. What I want to point out is that the trade school cannot take, in full, the place of apprenticeship, and the only solution is a combination between the school and the shop training. At the Toronto Technical School we have seventy boys from the plumbers' trade taking courses. They are getting those things we have been talking about—English, mathematics, drawing, and practical work. They cannot get all their practical work at the school, but somethings can be taught just as well at the school as in the shop—making joints, for instance. The boy needs, however, to get out on the job and come in direct contact with the actual problems, in order to obtain a really practical training. We want a closer co-ordination between the school and the trades. We have no cut and dry programme for dealing with the various trades, but what we are concerned with is to give the boy a good general education, including the elements of citizenship, and then get together with you as practical men and solve the problem of his practical training. I want to work out a course on the practical side that will be of real benefit to all concerned and will couple up the school very directly with industry, and I ask the leaders in the various lines of trade to assist in mapping out school courses and in effecting combinations between the school and industry.

Compulsory Attendance at Schools

"Of one thing I am quite convinced, you can't get all the boys to take courses unless some form of compulsion is used. Otherwise the majority will stay away. The plumbers are telling the boys that they must go to school or they will be apprentices—that is the best type of compulsion. At the last session of the Legislature, a measure was unanimously passed which will require all workers between the ages of fourteen and eighteen years to attend school a certain number of hours per year, to be arranged as conveniently as possible. I bespeak for this measure your most hearty support.

"I want to discuss with you several things. What should be taught in school in this trade and that trade? How is the best type of teacher to be obtained? We allow no man to teach a practical subject who has not himself had wide experience in the trade, including apprenticeship and successful work. It is often difficult to get men to become teachers. At the present time we are carrying on an experimental class for the training of teachers. One of the best teachers is a man who had no training whatever in teaching, but he seemed to just have a natural instinct for the work.

Others have no aptitude for it whatever. One of our biggest problems is to get the right type of man.

Appropriations for Technical Training

"We shall have no trouble with our equipment. The province has set aside a large sum and the Dominion Government has also appropriated $10,000,000 for the same purpose, to be expended during the next ten years by the different provinces. Just recently the Minister of Education signed an agreement under which there has been set aside for Ontario during the coming year the sum of $224,000. Next year the amount will be increased, so that we see our way clear to assist municipalities in putting up buildings and supplying equipment. Plans are now under way for schools at Brantford, Guelph, Kitchener and many other municipalities.

"In conclusion, what I would ask of you is to help me to develop the proper practical courses, to obtain teachers, and to more closely connect the work of the schools with your industry."

* * *

What the Plumbers are Doing in the Training of Apprentices

Mr. Geo. Clapperton, of Bennett & Wright, told of gathering something of what the plumbers were doing in the training of apprentices. "We have," he said, "seventy boys at the Technical School taking lessons, two nights a week. They are taking one hour of practical instruction, and one hour of mechanical drawing, mathematics,, history, etc., and if any one of you were to see the interest those boys are showing, I am sure you would get busy and have the boys in your line go there for technical education. Some time ago our association appointed a committee, of which I was a member, to try and bring forward some scheme to improve and uplift our trade. I am sorry to say that in the last few years the trade has gone back, because the men in the trade are not fitted to teach boys anything more than the mechanical end. We therefore asked the members of the Association that they should pick out from amongst their boys those who wanted to be mechanics and who were prepared to go on with the trade. After they had done so, we wrote to their parents and told them what we were going to do, and asked their co-operation. We told them three of our influential members had subscribed a fund whereby we could offer the boys some inducement to attend. The interest derived from the fund will be sufficient to provide four scholarships, two to be awarded from the technical school and two from our association. We got replies from most of the parents saying they were well pleased. We also have a report from the Technical School every week of those present and those absent, and we told the boys they must go to these classes every night, as if he didn't we would feel he did not want to learn the business. A week ago, we went to the Technical School and had the teacher explain what was being done, and it was a treat. I would advise anyone to go there of an evening and see for himself, and I think every man in the industry should go and help. The reason our trade has been going back is because we have depended on immigration. I want to try and impress upon the members of this association the necessity of taking the boys of our own city and giving them this technical education. If you do, they will be more than tradesmen in the future and put the industry where it belongs."

Architect and Builder Go Hand in Hand

Mr. A. Frank Wickson, President of the Royal Architectural Institute of Canada, spoke of the place of architecture in the life of the community. The architect and the builder went hand in hand and he believed good progress was being made by both. Many years ago some excellent work was done; then there came a period which, from the artistic point of view was wicked, but it was a great pleasure to be able to point out the type of building that was being put up in the city of Toronto at the present time.

Canadian Talent for Canadian Work

Mr. R. K. Shepard, of the Ontario Association of Architects, urged the necessity of conserving Canadian talent for Canadian work. Some time ago it had become rather fashionable to engage outside architects and engineers to design our buildings. It seemed a rather illogical policy for the government to spend large sums of money on technical schools and colleges, and then to do nothing to conserve the trained men produced by them for Canadian undertakings. He bespoke the co-operation of the association to which his hearers belonged in keeping Canadian construction work for Canadian architects and builders.

Mr. G. F. W. Price, the recently appointed city architect of Toronto, was a guest at the banquet and was given a very enthusiastic reception when called upon to speak. Mr. Price expressed his appreciation of the welcome given him. The building industry, he pointed out, was now in a very active condition. Commencing with October, Toronto had been making history. October, November, December and January, had each been, respectively, the largest months the city had had, and it was expected that February would also be the largest February.

A very humorous and entertaining address was given by Rev. A. Logan Geggie.

Mr. Geo. Crain, on behalf of the visitors, expressed their appreciation of the very enjoyable banquet and entertainment provided by the Toronto men.

Mr. Elgie, who was called upon to speak, declared that the contractors throughout the province were taking up very seriously the practical side of technical education, and that they realized that every boy required both technical and practical training. He also urged that no government had the right to bring a foreign element into the country without educating them.

* * *

Wednesday Morning Session

The first item of business on Wednesday morning was the appointment of committees to deal with the various subjects. The members of the Legal Committee were as follows: H. W. McLeod (chairman); R. J. Fuller, W. E. Dillon, T. Grace, J. H. Thomas, Peter McLarty, J. Bogue, L. A. Boss.

Resolutions Committee: Geo. Gander, L. A. Boss, R. Marson, John Whittaker.

Committee on Joint Industrial Council and Labor: N. E. Gibb (chairman); J. M. Lillow, W. H. Palmer, Peter McLarty, J. Bogue, H. J. Graham, W. E. Dillon, W. C. Northey, G. H. Thomas.

Nomination Committee: T. Grace, Ed. Charters, C.

F. Till, J. W. Frid, G. H. Thomas, T. Rayment, H. McLeod, L. A. Boss, J. Bogue, Geo. Crain.

Mr. N. E. Gibb, as convenor of the committee on Joint Industrial Councils and Labor, presented a paper dealing with the situation:

Objection to Lien Clause

Mr. W. E. Dillon reported regarding the activities of the Committee on the Lien Law during the past year. He pointed out that there was one clause in the Act to which objection had been taken because it benefited the general contractor more than the subcontractor. This was the clause which provided that the general contractor could lien a building within seven days after the issuance or refusal to issue a final certificate. The Retail Lumbermen's Association had also been taking the matter up, and both associations had been advised by Hon. Mr. Lucas to get together on the matter and bring in their joint resolutions. These, however, had not been put through, and it was decided, instead, to frame a complete new act. A committee had been appointed at the last session in this connection, but the members had been defeated in the recent election. The provincial association's committee had had some correspondence with the new Premier and Attorney-General, who asked them to make some recommendations. The Cabinet, they were advised, were ready to meet them at any time they might suggest.

The committee had also been instrumental in having the merit and demerit clause in the Workmen's Compensation Act repealed so far as the building trades were concerned.

Legislation on Technical Education

Regarding technical education, Mr. Dillon referred to their interview with Hon. Dr. Cody and Dr. Merchant. The Department of Education was convinced, as were the builders, that some form of compulsion was necessary. They were ready to give a certain amount of legislation if the builders would agree to the part time system. He also thought that both the provincial and Dominion organizations deserved credit for getting larger grants from the government for technical education.

Mr. Dillon also spoke of the formation of the Joint Industrial Council of the Toronto Building Trades. Very encouraging results had been obtained from it up to the present, and it had been clearly demonstrated that the employers and the workmen had much in common. Last year they had attempted to get the Premier of Ontario to consent to have all disputes settled through the Council. This was under consideration when the government was defeated. He thought this idea should be adopted throughout the Dominion.

Mr. W. W. Pearse on Building By-laws

Following the mid-day luncheon, Mr. W. W. Pearse, former city architect of Toronto, and now general manager of the Board of Education of that city, addressed the association. Mr. Pearse said it had been his fortune, during his period of office as city architect, to be asked to draft a new building by-law for Toronto. The question of drafting building by-laws was of vital importance to a city. If the by-law were simply jumped at and composed from other by-laws, the best results could not be expected. When they undertook the work in Toronto, the unfortunate thing was that they could get very little information regarding Canadian products. When they wanted to find the strength of material they had had to turn to the institutions to the south of the line. Ever since, he had been trying to preach the doctrine that there should be a central bureau in the Dominion for the testing of Canadian materials. Brick had been in use for some 6,000 years, and yet less was known about it than about many much more recently adopted structural materials. There had, for instance, been extensive laboratory tests on steel and concrete. In view of this situation, the speaker said he had induced the city council to make a grant of $500 for the purpose of carrying out tests on brick piers. (Details of these tests were given in the Contract Record issue of Feb. 19, 1919). The information gained, he believed, would help to save millions of dollars.

In regard to fire prevention, the question was a very large one. They had tried to find out through research the best fire protective devices and apparatus. The fire department had informed them that 90 per cent. of the fires started in the basement, and it is very difficult, as a rule, to get into the basements. Therefore, if the basements were straightened out it might be the means of effecting great saving.

Tests on Flat Slab Concrete Construction

Tests on flat-slab concrete construction had been carried out in conjunction with Toronto University, and it had been decided to adopt the Chicago code for this class of construction.

The question of economy was a very important one. Any fool could put up a building that would not fall down, but in order to build an economical structure, a man should know all about strength of materials and should make sure that he is not providing for live loads greater than safety required.

Workmen's Compensation — A. C. B. C. I. Claims Presented by Mr. J. C. Reilly

In the absence of Mr. J. P. Anglin, president of the Association of Canadian Building and Construction Industries, who was detained owing to illness in his family, Mr. J. C. Reilly, the general secretary of that organization, presented its claims to the members of the Provincial.

Mr. Samuel Price, chairman of the Workmen's Compensation Board, also addressed the Association, citing a number of individual instances as illustrative of the operation of the Compensation Act:

Awards in Cases of Death

A carpenter (John T. Moore, aged 50, in the employ of James B. Currie, Toronto), on October 17, 1919, slipped on a frosty roof and fell from the building on which he was working, dropping on to the verandah and thence to the ground, suffering injuries from which he died ten days later. His average wages were $30.64 a week. Fifty-five per cent. of this was paid by the Board to the widow for the ten days he lingered and upon his death an award was made giving the widow (aged 47) $30 a month for herself until death or re-marriage and $7.50 a month for one daughter while under 16. The capitalized value of the pension was $5,115. Doctor, hospital, and nursing bills to the amount of $243.35 were paid; also $75 for funeral expenses; making a total of $5,456 for the accident.

A laborer (Albert Pritchard, aged 38, in the employ of A. E. Ponsford Ltd., of St. Thomas), on July 3, 1919, (at London) was unloading material from a wagon, when the horses ran away, throwing him under the wagon causing his death the same day. He left a widow (aged 39) and three children under 16. The workman's average wage amounted to only $85.80 per month, and 55 per cent. of this, namely $47.19 a month, was awarded the widow for herself and three children. The capitalized value amounted to $6,752. Seventy-five dollars was paid for funeral expenses and $13 for doctor bill.

A workmen (Eli W. Hambleton, aged 65, in the employ of I. S. Rose, Newmarket, on July 30, 1919, was shingling on a bay window about 10 feet from the ground, when the scaffold collapsed, causing injuries from which the workman died. His widow is receiving a pension of $30 a month until death or remarriage and $75 were paid for funeral expenses, and $18 for doctor bill. There were no children under 16. The capitalized value of the pension was $3,703.

A Total Disability Case

A carpenter (Henry Stiver, aged 53, in the employ of H. G. Christman, Hamilton), on December 5, 1916, was working on scaffolding when a shore slipped out, causing the workman to lose his balance and to fall down an elevator shaft, a distance of 60 feet, on to a pile of lumber, causing injuries to his hip and right hand, which totally disabled him from work. His average weekly wages were $25.50. He was paid $14.03 a week, in bi-weekly payments, for 113 weeks, and was then awarded $60 a month for life. The capitalized value of the pension was $8,852, making the total cost of the accident $10,435.

A painter (Eli J. Wildfong, aged 31, in the employ of the T. Eaton Co., Ltd., Toronto), on June 26, 1919, fell from an extension ladder, fracturing his right arm near the elbow joint. His average earnings were $25 a week. He received $13.75 a week for 9 weeks while totally disabled, and for his permanent disability, consisting of some limitation of movement and weakness of the arm, he was awarded $100 cash and a pension of $8.50 a month for life. The capitalized value of the pension was $1,704. Medical aid to the amount of $151.25 was paid.

Awards for Temporary Injuries

A plumber (Lauson H. Eckhardt, aged 26, in the employ of D. N. Flanders, Ingersoll), on March 5, 1918, was carrying a pot of molten solder when it slipped from the pliers he was carrying it with, and splashed in his eye, badly injuring the sight of the eye. He was paid $11.41 a week while totally disabled, and for the permanent impairment of sight was awarded $50 cash and a pension of $6.50 a month for life. The capitalized value of the pension was $1,349. Twenty-one dollars and fifty cents was paid for medical aid.

A workmen (Mike Sedlick, aged 31, in the employ of W. H. Cooper, Hamilton), on August 5, 1919, when taking down upper scaffold, brace under his feet gave way and he fell from first floor to the basement, dislocating his shoulder. His average wages were $27.95 and he received $13.37 a week for 6-5/6 weeks till able to resume work, amounting to $103.22. There was no permanent disability. Twenty-one dollars and fifty cents was paid for medical aid.

A mason (Leonard Saint, aged 34, in the employ of the Yates Construction Company, Hamilton), on December 3, 1919, was going up hoist when cable broke and he fell a distance of 8 feet to the ground, injuring his legs and back. His average wages were $38.46 and he received $21.15 a week for 1-2/3 weeks, when he returned to work. There was no permanent disability. Doctor bills amounting to $9.05 were also paid.

Workmen's Compensation in Building Trades in 1919

Mr. Price also placed before the members a statement of what the board had actually done in the building industry during the year.

The total number of accidents in the building trades in which compensation or medical aid was paid during 1919 was 1,630, as against 1,609 during 1918. There were 18 fatal cases compensated during 1919, as against 24 in 1918.

Of the non-fatal cases 98 involved some degree of permanent disability, 1,070 temporary disability only, and 444 were cases in which medical aid only and no compensation was paid.

Mr. L. A. Boss, 2nd Vice- President

Assessments and Accident Cost

The assessments in the building trades for 1919, including estimated adjustments, amounted to a total of $294,723.99, the total number of employers contributing being about 5,500.

The accident cost for 1919, including estimates for cases not finally disposed of, is as follows: Compensation $261,061.18, and medical aid $30,973.67, giving a total of $292,034.85.

The year has thus been a favorable one, there being a small provisional balance on the right side of the ledger, as compared with the prior year when, according to the provisional statement as published in the report, there was a deficit, which, however, by reason of the adjustments turning out to be more than estimated, has been reduced by the completed figures, and which was more than taken care of by the surplus which was carried forward from prior years.

The figures for the various classes of industry are published in the Board's annual reports, those for the year last closed being provisional (contained in Table 1 of the report), the final figures, when all adjustments and all awards for accidents as far as possible have been completed, being given a year later (in Table 14 of the report).

Expenses

There will also be the matter of expenses to be taken care of. This amounted for the prior year to only 1.55 per cent. of the assessment. For the year just closed it will be about 1.65 per cent., the slight difference being caused by the fact that the Government grant toward expenses remained the same while both assessments and compensation proportionately increased by reason of the general increase in wages.

Rates of Assessment

Though after the rather unfavorable experience of 1918 it was feared it would not any longer be possible to carry the building trades at the rates that have prevailed for some years past, the 1919 figures are reassuring, and no advance seems at present to be necessary.

The new Secretary-treasurer of the organization, Mr. Geo. Gander

The rates have been much less than was expected when the Act was going into effect. The 1915 rates were the highest that have been charged. Since then in the building trades the rates have been practically constant—one of the few instances in the present times in which costs have not increased.

The following comparison with the rates in other places (compiled from the latest available rate lists) will be interesting—

Industry	Ont.	Ohio	Mich.	N.Y.	N.S.	Man.
Brick or Stone Masonry	1.50	2.85	7.52	8.74	2.00	2.10
Plastering	1.00	1.20	2.99	3.49	2.00	1.80
Carpentry, N.O.S.	1.50	2.10	7.52	7.85	2.00	2.10
Painting, N.O.S., and Decorating	1.00	4.95	5.46	6.34	1.50	2.40
Sheet Metal Work	1.50	1.85	4.54	5.28	2.30	3.25
Roofing	1.50	4.45	7.19	8.36	2.30	3.25
Electric Wiring	.80	.80	1.74	2.03	1.50	1.75
Plumbing	.80	1.20	1.67	1.94	1.50	1.50

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Following Mr. Price's address, Mr. Crain brought up the question of the Provincial Association's attitude to the A.C.B.C.I. Messrs. Dillon, Gander, Graham, Scott and Bogue, spoke strongly in favor of affiliation with the national association as provided for in its constitution, and on Mr. Crain's motion, it was unanimously resolved "that this Provincial Builders' and Supply Association, be affiliated with the Association of Canadian Building and Construction Industries and elect the three members to the National Council."

It was moved by Mr. Wright, and seconded by Mr. Charters, that the Association request the supply men to get together and see if anything could be done toward the stabilization of prices. Mr. Wright thought it would be well that advice to this effect should be sent to the convention of the Retail Lumbermen's Association which is to meet in Hamilton shortly. The motion was carried.

Mr. Elgie spoke of the work which the secretary, Mr. Wright, had done for the association during the past year. Nothing had been too much trouble for him and he had looked after the interests of the association very well. He thought, therefore that he should receive some tangible appreciation of his services.

On motion of Mr. Till, seconded by Mr. Lillow, an honorarium of $150 was voted to Mr. Wright.

Mr. Till expressed the opinion that the present per capita tax of $1.00 did not provide the Provincial Association with sufficient finances to place it in the position it should occupy. The tax had been fixed at a time when the expenses were smaller and he thought that now some increase should be made.

Mr. Crain moved that a committee of five should be appointed to thresh out this matter and bring in a budget. Mr. McFarren seconded the motion, which was carried.

Legislative Committee Report

The report of the Legislative Committee was brought in on Thursday morning, consisting of two resolutions, as follows:

That no amendments be made to the Compensation Act, or Lien Act, without first notifying the various bodies of employers that may be interested in those amendments. (Moved by Mr. Gander, seconded by Mr. Dillon)

That this association appeal to Aldermen Phinnemore and Maxwell to bring before the assessment commission the advisibility of proper assessment or taxation of foreign contractors, engaged in the construction industry in this city so that they will be placed on the same basis as local contractors. (Moved by Mr. Gander, seconded by Mr. Scott),

There was considerable discussion on the second resolution. Mr. Webster, of Galt, moved an amendment that the word "foreign" be deleted and the word "outside" substituted, and that a preamble be inserted that there was not desire to place any impediment to outside contractors doing business in any town or city, but that it was the purpose to place them on the same footing as the local contractor. Mr. Marson seconded this amendment.

An amendment to the amendment was proposed by Mr. Jackson, as follows:

"Whereas, it has been forcibly impressed upon this convention that contractors coming to the Province of Ontario from outside points and temporarily engaging in construction work do not, as a rule, pay the municipal taxes that the resident citizen pays.

"Therefore, it is resolved that we interview Aldermen Maxwell and Phinnemore to endeavor to have them, through the Toronto City Council, secure an amendment to the municipal tax by-laws so that persons temporarily carrying on construction work in the city of Toronto and not paying taxes in the Province of Ontario will be subject to the same municipal taxation as the resident citizen.

"It is felt that if this change is first made in Toronto, it will quickly become operative throughout all cities and towns in the Province."

Mr. Jackson thought they would be getting down to a very narrow viewpoint if they asked for the taxation of each other.

Mr. Gibb said he had done work in eleven different municipalities last year and if he were to be taxed in all it would practically mean his giving up business.

Mr. Jackson's amendment was carried.

Regarding standardization of wages, it was moved by Mr. Penn, seconded by Mr. Crain, "that the executive of the Provincial Association was of the opinion that the time was not opportune to standardize wages in zones throughout the province, and that the Dominion Association be requested, to take up this matter."

Explanation of "Open Price" Plan

Mr. W. R. Carr, of the Contract Record, was called upon by Mr. Elgie to speak on the "Open Price" plan. Mr. Carr pointed out that this plan was being used by the electrical contractors. It was, he said, very simple in its operation. It was merely an arrangement by which the contractors exchanged tenders on their different jobs through a clearing house. In the first place it was essential to have some disinterested party act in this capacity. There were two points to note in particular. First, there was no suggestion of collusion among the contractors to fix the price or keep the prices higher than they ought to be. Secondly, the main advantage seemed to be that the contractors often got together and compared their figures and notes and saw where they had made mistakes. The speaker cited the case of a job worth some $40,000, on which the highest bid was around $39,000, the next $37,000, the next $34,000, the next $32,000, and still another for a smaller amount. After the contract was let the contractors got together and discussed the big discrepancies. They brought figures and estimates and took up the various items—material, labor, profits, and overhead. In this way they discovered how and where they differed, and it often happened that serious mistakes were discovered. Through this comparison of bids from time to time, however, they were finally reaching a stage where they were standardizing, and it was hoped that eventually they would arrive at a standardized sheet covering every item, so that nothing would ever be omitted. In New York, through the operation of this plan, it was said they had got the differences in this bids down to hundred's of dollars now instead of thousands.

For the purpose of the scheme the different contractors were supplied with special letterhead forms, on which the various items on the job were noted—cost of material, cost of labor, percentage of overhead, and profit—and these forms when filled in were submitted to the clearing house.

In reply to a question by Mr. Elgie regarding the amount of overhead the electrical contractor's usually included, Mr. Carr said that there was in Chicago an estimators' association, which had worked on figures prepared by the contractors over a series of years and had compiled a table showing the percentage of overhead. These varied from 55 per cent. on a $500 job to 40 per cent. on a $1,000 job, 30 per cent. on $2,000. and when they got up to $150,000, the percentage was about 8.

A Suggested Code of Ethics

Mr. Elgie also called upon Mr. Carr to make some remarks on ethics in the contracting business. The following was the code suggested by Mr. Carr:

The members of the association should regard themselves as having well defined obligations: first to the public, and second, to their fellow contractors.

1. Obligations to the Public.

The contractor should carry out all construction work efficiently and economically, having in mind, at all times, the best interests of his client. He should never, knowingly, accept work at a figure that will not yield him a fair profit, nor should he ever exact, from any client, more than a fair profit. To this end, it is the duty of every contractor to qualify himself, by careful study, to prepare accurate and reliable cost figures upon which to base his tenders, and to so acquaint himself with the details of his business, through a proper record and accounting system, that the chances of error in the bid he submits on any piece of construction work may be reduced to a minimum.

2. Obligations to Fellow Contractors.

It is the duty of every contractor to so co-operate with his fellow members that all building and construction work may yield a fair profit. This means the elimination of such practices as undercutting of bid prices or the submission of a bid price which the tenderer knows to be too low.

Member contractors should discourage, in every way, the fallacious theory, generally held by the public that the lowest tender is the cheapest. Clients must be brought to realize the value of "service". It becomes, therefore, the duty of every contractor to seek to establish in the public mind the fact that discrepancies in bid prices are largely a matter of the value of the "service" included.

Member contractors should endeavor to uphold one another's character and ability, to the end that the public may have greater confidence and respect for the industry.

A vote of thanks to the Contract Record for its services to the building industry throughout the province was moved by Mr. Geo. Crain and seconded by Mr. Wright.

Organization Committee Report

The report of the Organization Committee, brought in by Mr. Till, made the following recommendations:

That Rule 14 re annual dues be amended to read $2.00 per capita, and that in places where there is not in existence any organized body of employers engaged in the building and construction business, the fees for annual membership in this organization shall be $5.00. (Moved by Mr. Till, seconded by Mr. Rayment).

That the secretary's office be permanently located in Toronto, and his services shall be remunerated by the payment of $300.00 per year, to be paid semi-annually. (Moved by Mr. Crain, seconded by Mr. Scott).

That whereas we, having unanimously joined with the National body, therefore recommend that the president, secretary-treasurer, and one other member be appointed as the councillors representing this association. (Moved by Mr. Crain, seconded by Mr. Boss).

In regard to the recommendation that the secretary's office be located permanently at Toronto, Mr. Till cited the following as reasons for this measure: (1) Toronto is the seat of the provincial government; (2) it is the commercial and financial centre of the province; (3) it is the headquarters of the Workmen's Compensation Board; (4) it is the headquarters of other bodies of employers—such as the Canadian Manufacturers' Association, Lumbermen's Association, etc.; (5) it will be easier to keep in touch with the headquarters of the A.C.B.C.I. ; (6) The association will have better standing from the viewpoint of other organizations.

On motion of Mr. Crain, seconded by Mr. Charters, the report of the Committee on organization was adopted.

Industrial Council and Labor Committee Report

The report presented by Mr. Gibb, for the committee on industrial Councils and Labor, was taken up by committee of the whole, and the various recommendations—regarding rental charges for equipment, overhead expenses, and depreciation—were approved.

Your Committee on Industrial Council and Labor beg to submit the following report:

We believe that the building industry can best be improved by a careful study of past faults and by taking measures to eliminate them in the future. Success should be noted and wherever possible, improvements made.

The first step to success should be a thorough organization of all contractors in each locality, with a determination to give to the general public the very best service at the least possible expense.

That can only be attained by a careful study of the costs of equipment, over head, depreciation, wages, and material.

Equipment, that is everything owned or rented by the contractor, and used on the work, should have an actual rental charge from the time that it leaves the contractor's premises until it is loaded for return, no matter whether the job be contract, day work, or cost-plus plan.

Overhead, as its name indicates, covers those items which do not directly show up, or can not be accurately measured, in the finished work. They include such items as rent, insurance, supervision, telephone, non-productive labor, and supplies which do not enter directly into the work.

Depreciation varies with the different classes of equipment, but usually can be classed under four heads:

1. Depreciation resulting from wear and tear.
2. Depreciation resulting from age.
3. Depreciation due to inadequacy.
4. Depreciation due to obsolescence.

All of these factors must be given the most careful consideration in determining the average life of an industrial equipment. Knowing the average life and scrap value, it is a comparatively simple task to determine an actual rate of depreciation, which, when applied to the items under consideration, will give a corresponding depreciation in dollars per annum.

First of all what are wages? In the broad meaning of the word, wages are the return of effort.

And in order to give to the worker a fair return on his effort, it requires a thorough grading of the worker and instead of standardizing the pay, the job should be standardized.

Very often a man is hired by "sizing him up" but if his qualifications are analyzed, there would be less uncertainty as to his fitness for the job.

His value may be arrived at by a knowledge of—

(1) Experience and education, length of service in the trade. This furnishes a rough idea of a worker's ability and perhaps character.

(2) Employer previously associated with in the trade and length of service. A worker's connection for a long period of time with a contractor or firm known for a high standard of efficient production furnishes an important indication of his ability.

(3) Education. The knowledge of whether or not a worker has had a common or high school education, or special training along certain lines, serves as a guide in determining a worker's value.

(4) Knowledge of work. The extent of a worker's knowledge and his ability to apply that knowledge to his work is an essential point to be determined. This knowledge of work includes familiarity with hand tools, measuring devices and materials common to the trade. The possession by an employee of various tools, applying to the trade, is an indication that the worker has a knowledge of their use.

(5) General value to his employer. Accuracy of workmanship—quality of production. The degree of accuracy which the worker can consistently maintain is an essential measure of his value on certain work. The skill in doing this may depend on the aid given him, as some work must be carried out through a worker's own judgment and ability, while other work may be done with a helper. Quality of work is always a feature to be considered.

By adopting the policy of standardizing the job and paying the worker what he is worth, it should be an incentive for men to become more efficient, and try to get to the top of the mechanical ladder. This can only be accomplished by educating the worker to his responsibility as a producer of the industrial progress of the community. It may mean that salary is but part of his wage. The opportunity of practicing his trade pleasantly, the desirable character of his companions, and other considerations, may help materially to make up the return of his effort. But if he wants a greater return on his effort, he must become more efficient. He may have ambition, and energy, but through lack of training, he wastes it. He does things in a haphazard, hit-or-miss fashion, whereas the efficient man knows what to do and does it. The efficient man does the thing, does it right, and does it without any waste motion. Efficiency is the brilliant use of common sense, which the worker should remember. When they have signed an agreement as to rates of pay for a limited time, they should have sufficient honor to abide by that agreement. The experience of a great many contractors last year was that the workers failed to back up their signature to a contract, and something will have to be done if the contractor is to continue to take a part in the industrial development of the community.

Your committee in closing has in mind a saying from Kipling:—

It ain't the guns nor armaments
Nor funds that they can pay,
But the close co-operation that
makes them win the day;
It ain't the individual, nor the
army as a whole,
But the everlastin' teamwork
of every blooming soul.

Report of Legal Committee

The report of the Legal Committee was next presented:

Your Committee beg to recommend the following resolutions:

(1) That the Provincial Builders' and Supply Association of Ontario approach the Provincial Government and request them to follow the policy of the late Government, and appoint a committee to take evidence and draft a complete new Mechanics Lien Act, and this Association appoint a standing committee to follow up this matter to see that the interests of our industry are protected.

(2) That the Provincial Builders' and Supply Association of Ontario approach the Ontario Government and request that they increase their grant for administration of the Workmen's Compensation Act to cover fully the increased expense of such administration.

(3) That the Provincial Builders' and Supply Association take steps to have the Provincial and Municipal authorities make optional the furnishing of bids in place of certified cheques with tenders for public works.

(4) That the Provincial Builders' and Supply Association take steps to have enactments passed to prohibit public works being executed by day labor until such time work has been advertised and contractors given an opportunity to tender thereon. Also all tenders on public works to be opened in public.

(5) That we approach the Provincial Government and request that no amendments be made to the Workmen's Compensation Act, and that no legislation be enacted that may effect our industry without first giving due notice to the Provincial Builders' and Supply Association of said proposals, so that we may have an opportunity to present our objections, or approval so that the interests of our industry are properly protected.

The various recommendations in this report were taken up one by one and approved.

* * *

Mr. Till brought in a motion, that the incoming president of this organization appoint a committee forthwith to wait upon the Minister of Education to confer with him regarding technical education and the inauguration of an apprenticeship system to operate in conjunction with the existing sister organization.

Mr. Dillon, in seconding the motion, declared that this was a very vital question. Eighty-five per cent. of the boys at present were working in positions of unskilled labor.

In answer to an enquiry by Mr. Wright, in regard to how boys in rural districts would be affected by the requirement of technical education, Mr. Dillon pointed out that it was provided that boys in districts where no technical school existed might receive correspondence courses.

Mr. Elgie stated that the masons' section of the Toronto Builders' Exchange was at present paying 40, 50 and 60 cents an hour to induce boys to serve their time.

Mr. Gander pointed out that if the boys were to receive technical training, the employers would have to be prepared to accept the part time system.

The motion carried.

The report of the Nominating Committee which was as follows, was accepted in toto:

New Officers

President, R. Marson, Stratford; First Vice-president, N. E. Gibb, Sarnia; Second Vice-president, L. A. Boss, London; Secretary-treasurer, Geo. Gander, Toronto. Directors—Chatham, T. Rayment; London, R. G. Wilson; Sarnia, T. Grace; Galt, Geo. Thomas; Hamilton, J. M. Piggott; Toronto, C. T. Penn, H. G. Elgie (Past-President); Peterborough, John Bogue; Sault Ste. Marie, Peter McLarty; Ottawa, H. J. Graham.

Representatives to National Council of A.C.B.C.I. —R. Marson, Geo. Gander, J. M. Piggott.

Mr. Marson, on taking the chair, expressed his appreciation of the honor conferred upon him and promised his best efforts on behalf of the Association.

Mr. Crain, seconded by Mr. Gibb, moved that the thanks of the convention be tendered to the retiring officers.

The best advice of the retiring president, Mr. Elgie, was that everything in the Association should be above board. That was vital to its last success and to its standing in the eyes of the public.

Mr. Boss, on behalf of the outside delegates, tendered a vote of thanks to the Toronto Builders' Exchange for their entertainment.

Mr. Scott moved that Toronto be made the convention city of the Provincial Accociation. This motion was, however, afterwards withdrawn, and it was decided on motion of Mr. Gibb, seconded by Mr. Elgie, that the choice of the place for the next convention be left to the incoming executive.

Mr. Gander moved the Legislative Committee for the coming year be composed of the following: Aldermen Phinnemore, W. E. Dillon, Geo. Gander, R. Marson, and Mr. Maxwell. Carried.

On motion of Mr. Crain, seconded by Mr. Till, it was decided that the association should take advantage of the clause in the Workmen's Compensation

(Concluded on Page 162)

Hints for the Contractor

That May Save Him Time and Money—We Will Pay for All Accepted Items—Send One In

Blueprints and Drawings Waterproofed by Saturating with Molten Paraffin Wax

By F. A. McLean*

ARCHITECTS, engineers, contractors, linemen, etc., often have occasion to refer to drawings and blueprints, in all kinds of weather, and usually find that before long their prints are in a very dilapidated condition. A simple way of overcoming this trouble is to render them waterproof by saturating them with paraffine wax such as is used for sealing fruit jars, etc., and sold under the name of Parowax.

If the prints are placed directly in a pan filled with this molten wax, they will soak up too much of it and will always feel more or less greasy to the touch. The most convenient way, therefore, is to soak a number of pieces of absorbent cotton cloth a foot or more square, in the wax. When these pieces of cloth are cool lay as many as are required (depending on the size of the blueprint) on a table or other smooth surface, place the print on top of these and then on top of the print lay more of the cloths until it is entirely covered. After this is done it is only necessary to run a hot iron over them for a few moments. The print will immediately absorb the paraffine until the surfaces become saturated. If the table on which the work is carried out has a highly finished surface, a layer or two of heavy wrapping paper should be placed between the cloths and the table. Should one of the family irons be used in the process it would also be a good plan to interpose a piece of wrapping paper between the iron and the cloth also, as it will prevent the iron from being fouled with the wax.

Collapsible Circular Scaffold Makes for Rapid Construction of Concrete Silos

A COLLAPSIBLE circular scaffold was a factor in the rapid building of cement silos in Minnesota where five men erected nine silos in 14 days with an apparatus that is apparently adaptable for the construction of any vertical cylinders made of pre-cast concrete units.

This scaffold, as described in "Contracting," has a gas pipe skeleton framework consisting of a rectangle inscribed in a circle and provided with diagonals intersecting at right angles. The diagonals clear the center point a few inches where they overlap and are connected by a toggle joint attachment that can be operated by a horizontal wheel and sweep lever to expand or contract the circle. The same toggle also operates four horizontal wooden radials in the plane of the scaffold and intermediate between the diagonals, which bisect the sides of the square and project beyond the circle. When the circle is expanded these wooden radials rest on the tops of the staves and support the framework which is covered with sufficient planks to provide a working platform.

The staves are about 30 in. long, and have staggered butt joints. Sheaves attached to the tops of the projecting staves at quarter points of the circle provide for hoisting ropes by which the scaffold is raised 15 in. for every new course of staves.

After the staves are erected and hooped the scaffold is collapsed slightly to clear it from the walls and is lowered a convenient distance of 6 or 7 ft. at a time to provide support for the men applying the inside wash. This scaffold is designed and used by the Clayford Silo Co., Clarksfield, Minnesota. It is adjustable for different diameters and is so light that it is moved from one job to another transported on a semi-trailer coupled behind the automobile that carries the working crew.

Provincial Builders' and Supply Association

(Concluded from page 161)

Act providing for the formation of an accident prevention association, and that the formation of this association be left to the incoming executive.

There was some discussion as to the suggestion made in the address of the president regarding the stabilization of prices.

Mr. McFarren, of the Interprovincial Brick Co., did not see how it would be possible for the supply men to fix their prices for any length of time, inasmuch as they did not know their costs. The supply men often made prices good for a job even though it was unprofitable business. He took the viewpoint that the contractors were somewhat arbitrary.

Mr. Elgie, however, pointed out that there was nothing arbitrary in his suggestion. It was not a demand, but merely a proposal that the supply men might get together and discuss the possibility of stabilizing prices. He mentioned a job on which one item of the material had gone up $1,000 since he had taken the contract. All he wanted was that they should get together to help one another. He also pointed out that the contractor was often placed in a difficult and humiliating position by delay on the part of the owner to award the contract, as in some cases, when he received the contract, the prices of materials had in the meantime been raised.

Mr. Gibb said that in the Sarnia Builders' Exchange a few weeks previous the contractors had called a meeting and asked the supply men to take some action with the fixing of prices. The supplymen had agreed to quote prices that would remain fixed until March 15, and at that date, they stated that they would quote prices that would remain good till June 15.

No definite action was decided upon by the convention.

Mr. Elgie moved a vote of thanks to the convention committee,—Messrs. Till, Penn, Fraser and Dillon—for the excellent work they had done towards making the convention a success.

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*Publicity department, Canadian Ingersoll-Rand Co., Sherbrooke, Que.

Making St. John, N. B., an Up-to-date Port

Contract to be Completed in 1922 Provides for Long Breakwater, Entrance Channel and Basin, Wharves and Dry Dock

THE Government of the Dominion of Canada have under construction in Courtenay Bay, St. John, N. B., a large and comprehensive scheme of harbour development, the object of which is to cope with the increasing demands of Canada's large export and import trade. In conjunction with these improvements, there are also under course of construction a dry dock and well equipped ship repair plant.

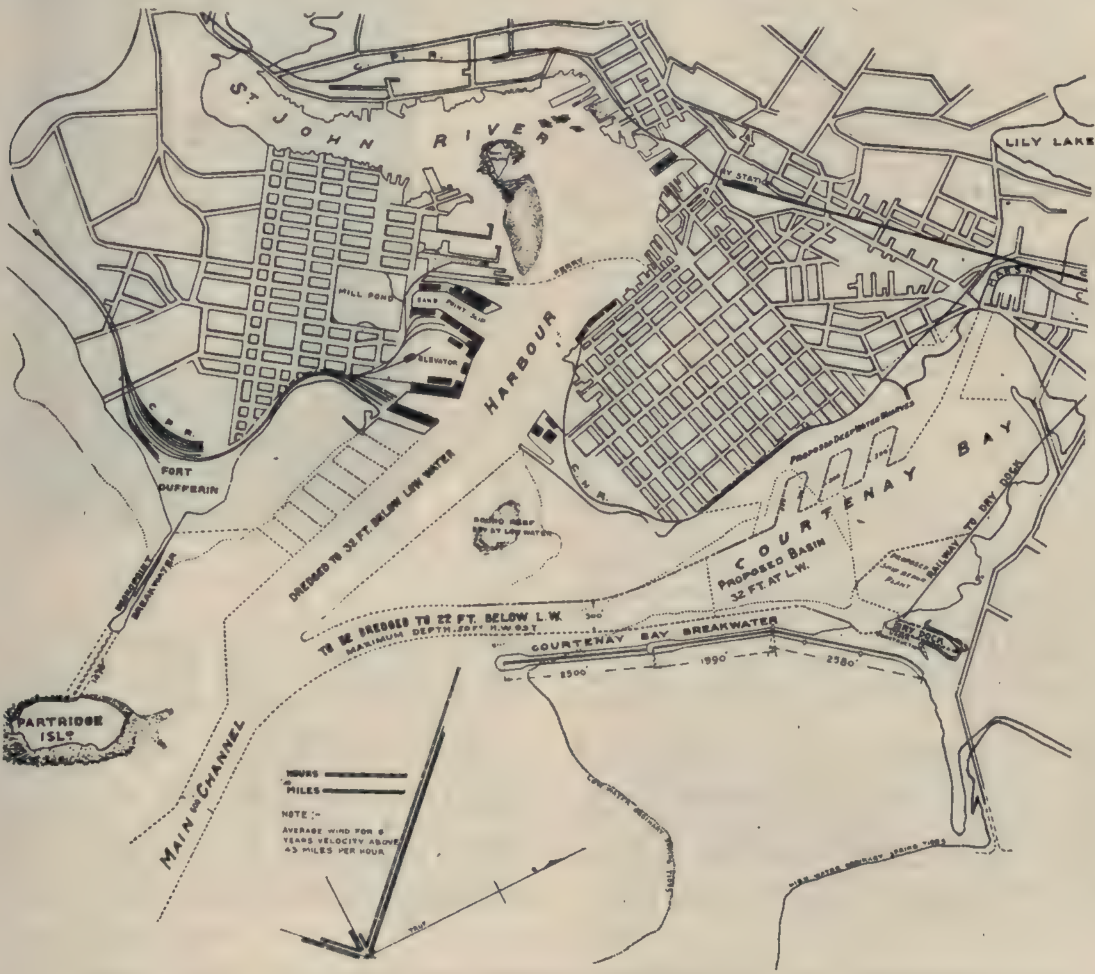
By reason of its location on the Atlantic coast, with the shortest rail haul to the interior, and the terminus of two large transcontinental railway lines, St. John is Canada's chief and natural winterport and, as regards volume of trade, is the second ocean port of Canada.

The total value of exports and imports during recent years were as follows:

	Imports	Exports	Total
1915...	$8,847,049	$ 43,081,929	$ 51,928,978
1916...	11,057,022	119,490,818	130,547,840
1917...	14,956,948	186,259,101	201,216,049
1918...	16,787,150	200.783,647	217,570,797
1919...	15,702,446	149,986,167	165,688,613
	$67,350,615	$699,601,662	$766,952,277

The facilities to take care of this trade in the main harbour are inadequate and it was this condition that led to the consideration of the advantages of Courtenay Bay and to the final adoption of the scheme of improvements that is now being carried on.

The map of the harbour of St. John shows the present deep water wharves and accommodation in the main harbour and the location of Courtenay Bay and its relation to St. John and the system of the Canadian National Railways.



Map of St. John, N.B., showing present facilities and development under way in Courtenay Bay

Courtenay Bay is particularly well adapted to the further expansion in harbour and terminal facilities required by St. John. It has a considerable area, an advantage over the present main harbour, and it is free from objectionable currents which make navigation and berthing of vessels difficult. There is ample room for industrial, railway and terminal development at the head and on the east side of the bay and easy access is afforded the Canadian National Railways which has lines on both sides, one of which terminates at the dry dock now under construction.

General Description of Improvements

The works now under construction are comprised in two contracts known as the "Harbour Works Con-

No. 6

Canada's Contractors—John V. Gray

One of the well-known figures in Canadian contracting circles is John V. Gray, president and general manager of the John V. Gray Construction Co., Ltd., general contractors, of Toronto. From early youth Mr. Gray's inclinations have been directed toward construction in one way or another, and as a result of over thirty years' experience, he has acquired a thorough familiarity with all branches of the building business. Commencing as a carpenter, he has risen successively through the grades of outside and factory foreman, superintendent and estimator to member of a general contracting concern, and finally to principal in the John V. Gray Construction Company. For seven years Mr. Gray was with one of the older successful general contracting firms of Detroit, Teakle & Golden, as their factory superintendent, and later general superintendent and estimator in charge of outside work. Among the well-known jobs which this concern handled, during Mr. Gray's connection with it, was the original Packard Motor Car plant, which was the nucleus of the present extensive works. Mr. Gray left this firm to come to Toronto, where, for twelve years, he has been engaged in general contracting.

The firm of which he is now the head has carried out some very notable pieces of construction for well-known corporations, and it speaks well for the class of work which he turns out that these companies have given him repeat contracts from year to year. Among the companies which are his clients are: The Riordan Pulp & Paper Company; Harris Abattoir Company; Canadian National Carbon Company; Canadian Fairbanks-Morse Company; Gunn's, Limited; International Harvester Company; Swift Canadian Company; Canada Cycle & Motor Company; Union Stockyards of Toronto, Limited; Canadian Rumely Company; the Albert Kerr Company. Some of the jobs which have just recently been carried out, or which are in progress, are: Four-storey concrete factory for Dunlop Tire & Rubber Goods Company; seven-storey factory for the Cowan Company, Toronto; warehouse for W. Clark Company, Harrow, Ont.; addition to factory for Brunswick-Balke-Collender Company, Toronto; fireproof factory for the Champion Spark Plug Company, Windsor; factory for Horne Bros. Woolen Company, Lindsay.

Although in a position where administrative and executive duties demand a great deal of his attention, nevertheless, Mr. Gray likes, as far as possible, to give his personal attention to the contracts which his firm handles. The principle on which he works is to produce satisfied customers and, as a means to this end, he believes that personal supervision is a safeguard against careless or inefficient work, and forms a guarantee to the owner of careful building and a thoroughly complete job.

Mr. Gray is thoroughly convinced of the merits of co-operation between employer and employee and has spent much time developing in his own organization that esprit de corps which is such a valuable asset in any concern. The result has been that his organization is remarkable for the harmony which prevails.

Mr. John V. Gray

Mr. Gray believes in making his staff feel that they are part of the business and a further move in this direction is shortly to be made, when a reorganization will introduce an even greater degree of co-operation and harmony than now exists. As a result of the thoroughness with which Mr. Gray's firm handles its work, it has been consistently growing to such an extent that more commodious quarters have just been acquired.

Mr. Gray is an enthusiast for the out-of-doors and when he wishes to forget the cares of contracting, he finds a suitable relaxation in hunting and fishing. He is a member of the Engineers' Club of Toronto, Board of Trade and the Toronto Builders' Exchange.

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tract" and the "Dry Dock Contract." These contracts were taken over in July of last year, by the St. John Dry Dock and Shipbuilding Company, the principals of which company have engaged for some years in harbour developments on the great lakes and in transportation and shipbuilding.

The "Harbour Works Contract" provides for the construction of a breakwater, entrance channel and basin and deep water wharves. The breakwater is of the rubble mound type, 7070 feet in length, with top width of 20 feet, outer slope one on two horizontal and inner slope one on one and a half horizontal. The outer end or head has both outer and inner slopes of one on three horizontal. Large stones of from 2 to 25 tons cover the slopes. The last extension of 2,500 feet in length has been under construction since December of last year and is now at its ultimate length and almost completed.

Entrance Channel and Basin

Navigable access to the bay will be afforded by an entrance channel 500 feet in width with a depth of 22 feet at lowest water. With the range of tide that obtains, the depth in this channel at high water will vary from 43 feet to 50 feet. The entrance channel enlarges into a turning basin, which will have a depth of 32 feet at lowest water.

The removal of some 7,000,000 cubic yards of soft material is required in the entrance channel and basin and a hydraulic dredge is now at work in the basin and it is proposed to place a bucket ladder dredge at work shortly in the entrance channel.

On the west side of Courtenay Bay there will be constructed a series of deep water wharves affording some 6,500 feet of berth space, with a depth of 32 feet at lowest water.

Dry Dock and Ship Repair Yard

Under the terms of "The Dry Dock's Subsidies Act, 1910," and "The Dry Docks Amendment Act, 1917," the St. John Dry Dock and Shipbuilding Company have undertaken to construct and operate a dry dock of the first class for naval and general purposes.

The Act specifies a first class dry dock as:

"(a) Dry docks, other than floating dry docks, of dimensions when completed of not less than the principal dimensions next hereinafter mentioned, that is to say, clear length on bottom from caisson groove or hollow quoin to head, eleven hundred and fifty feet, clear width of entrance, one hundred and twenty-five feet, depth of water over sill at high water ordinary spring tides, thirty-eight feet."

There is also included in the Act the following proviso:

"Provided, however, that any such dry dock shall not, for the purposes of this Act, be deemed to be a dry dock of the first class unless there can be received and repaired therein with ease and safety the largest ships or vessels of the British Navy existing at the time at which the contract is entered into."

Details of the Dry Dock

The dry dock, the location of which is shown on the map of the harbour, has the following general dimensions: Length, 1150 feet; width at coping, 133 feet; depth on sill at high water, 42 feet. By a recent change, the sill will be lowered two feet thus giving a depth of that much more than is shown on the general plan.

The dry dock is the only one on the Canadian Atlantic coast capable of taking vessels over 600 ft. in length and will embody in its construction the latest and most efficient features of dry dock construction.

Provision is made by an intermediate sill and caisson to use separate portions of the dock 650 feet and 500 feet in length, to suit the size of vessels to be accommodated. The inner and outer entrances will be closed by floating caissons, two of these being provided.

The pumping equipment will consist of three 52 inch vertical centrifugal motor driven pumps, capable of unwatering the dock in two hours and a half.

The dock will be equipped with a travelling crane capable of lifting 40 tons at a reach of one-half the width of the dock.

To the north of and immediately adjoining the dock, on a reclaimed area, there will be established an extensive ship repair yard which will include the following buildings: Main office; boiler, engine and machinery shops; steel and brass foundries; joiner shop; plater and framer shops; blacksmith shop; pattern shop; stores and moulding loft; power house.

The estimated cost of the dry dock is $5,500,000, of which sum the ship repair equipment will cost $1,100,000.

Completion of the two contracts is required by July of 1922, but at the present rate of progress it is anticipated that all these works will be finished in 1921.

Mainly Constructional

East and West—From Coast to Coast

Building permits issued in Ottawa for January, 1920, total $79,150, as against $51,050 for January, 1919, an increase of $28,100.

A by-law providing $100,000 to be spent on county highways during the present year was passed at a recent meeting of the county council of Elgin, Ont.

Kitchener Construction Co., Kitchener, Ont., announced recently that plans are being made for the erection of from 400 to 500 houses in Kitchener during the year.

The county councils of Leeds and Grenville, Ont., at their recent meeting in Brockville, passed a by-law providing for the expenditure of $275,000 on county roads this year.

The report of the Commission of Conservation shows a total fire loss in Canada, during 1919, of approximately $23,500,000, or a waste equal to $2.90 per capita of the population.

Building figures compiled for Canada during the year 1919 show a total expenditure of $73,684,453 as against $35,454,930 for the year 1918. Toronto's total of $19,420,000 heads the list of cities.

The officers of the Chamber of Commerce, London, Ont., report they have secured $160,000 in their campaign to raise $500,000 for the erection of a large hotel in London. The balance of the local subscription is in sight and efforts are now being made to attract outside investors.

The Otis-Fensom Elevator Company have opened a district sales and service office in the old Board of Trade building, Hamilton, and will carry a complete stock of repair parts, supplies and lubricants. This branch will be in charge of Mr. John Parkin, district sales manager.

The Bricklayers' Union and the Builders' Exchange, at Toronto, have reached the following agreement in regard to the wage question: Bricklayers are to receive ninety cents an hour until April 1; one dollar an hour for the balance of the year; weekly pay system to commence May 1.

Parliament, at the coming session, will be asked to vote the sum of $21,000,000 towards the cost of carrying out public works improvements throughout the Dominion during the fiscal year 1920-1921. These projects include, harbor works at Toronto and St. John, N. B., wharves at Fort William, Ont., breakwater at Port Arthur, Ont., and drydock at Esquimalt, B.C.

It is rumored that the Toronto Housing Commission are not in favor of continuing their activities and have asked that they be relieved from their responsibilities. Lack of demand for the Commission's houses and the high price of building materials are given as the reasons for the proposed cessation of activities. Practically all the houses erected by the Commission last season, however, have been occupied.

The following wage scale has been submitted to the builders of Ottawa by the members of the various branches of the building trades, which they will demand to take effect May 1: Bricklayers, masons, stonecutters, marble tile workers, $1 an hour; carpenters, 85 cents; sheet metal workers, 85 cents; plasterers, 85 cents; painters, paperhangers and decorators, 80 cents; cement finishers, 75 cents; stationary engineers, 70 to 75 cents; laborers, 65 cents.

A deputation of municipal authorities of Chatham, Ont., waited on Hon. F. C. Biggs, Minister of Public Works, recently, for the purpose of securing his co-operation in having the present act, which limits an urban municipality to the expenditure of half a mill of its taxes on suburban roads, changed at the coming session. The act as it stands will not permit the municipality to carry out its contemplated road program during the coming construction season.

The election of officers at the 9th annual convention of the Ontario Granite & Marble Dealers' Association, held recently in Toronto, resulted as follows: J. W. Hutchison, Aylmer, president; C. Jones, London, 1st vice-president; H. N. Thomas, Hamilton, 2nd vice-president, and Frank Creber, Toronto, secretary-treasurer. The executive committee for the year will consists of the following: R. D. McIntosh, C. Wardell, S. H. Rutledge, Geo. D. MacKenzie and James Morris.

The proposal of Mr. N. Cauchon to construct a deep-water canal from Montreal via the Ottawa River to near the city of Ottawa, then cutting across country to link up with the St. Lawrence at Cardinal, will be laid before the Joint International Commission. It is claimed that this plan would be less expensive and not offer as great engineering difficulties as would the deepening of the St. Lawrence canal system between Cardinal and Montreal. The Ottawa Board of Trade has endorsed the proposal.

Mr. G. F. W. Price, Toronto's New City Architect

Mr. G. F. W. Price, who was last week appointed by the Toronto city council to succeed Mr. W. W. Pearse, as city architect and superintendent of building, has been in the city architect's department for about 15 years, latterly as assistant city architect and chief inspector. He was born in Belfast, Ireland, 52 years ago and came to Toronto in 1879, receiving his education in Toronto public and high schools and subsequently at the Methodist College, Belfast and the Belfast Technical School. Mr. Price served his apprenticeship as an architect with Mr. E. J. Lennox, of Toronto, and was later employed as a draftsman in the offices of Edwards & Webster, Toronto; Darling & Curry, Toronto, and LeHommedeau & Son, New York. He was also chief draughtsman for: W. G. Storm, Toronto; Darling & Pearson, Toronto; S. G. Curry, Toronto; Geo. Millar & Co., Toronto, and James Balfour, Hamilton. He also spent two and one-half years in the office of W. J. Gilleland, civil engineer, Belfast, and was on the work of the building of the city hall, Toronto, for about four and one-half years. He came to the City Architect's Department about 15 years ago in the capacity of an engineer and was later appointed assistant city architect and chief inspector. While in this latter position he had personal charge of the inspection of over two hundred million dollars' worth of work. Mr. Price has been a keen student of fire prevention for the last ten years and during that period has represented his department at different conventions in this connection.

City Architect of Toronto,
Mr. G. F. W. Price

Personal

Mr. W. J. Moore, Pembroke, Ont., will succeed J. R. McQuigge, as road superintendent of Renfrew County, Ont.

Reeves Jenkins, of Mariposa, Tompkins, of Fenelon, and Southam of Verulam Townships, have been elected members of the Victoria County, Ont., Good Roads Board.

Mr. R. McDowell, who has been consulting engineer for the County of Grey, Ont., for over a year, has been permanently appointed to the position of county engineer.

Mr. James J. Fletcher, for the past five years master mechanic at the Harbor Commission, Toronto, who has resigned to become connected with the Nukol Co., was presented with a travelling bag recently by Assistant Superintendent Mahoney.

The Niagara Falls Park Commission has secured the services of Mr. Thos. Adams, town planning adviser to the Commission of Conservation, Ottawa. Mr. Adams will devote part of his time, outside his regular duties, to the interests of the Park Commission.

Mr. Arthur Sande, consulting engineer, Hamilton, Ont., formerly with B. H. Prack, industrial engineer, Toronto, has been made an associate member of the Engineering Institute of Canada; member of the American Society for Testing Materials; associate member of the National Fire Production Association and a member of the American Association of Engineers.

Mr. Henry Terrault will succeed T. W. Lesage as waterworks superintendent of Montreal, the latter gentleman resigning, after nearly forty years of service in the Montreal Waterworks Department, to take over the position of consulting engineer in the city's Public Works Department. Mr. Terrault was formerly connected with the Government Shipyards, at Sorel, Que.

Mr. J. R. M. Fairbairn, chief engineer of the Canadian Pacific Railway is one of the nominees for the directorate of the American Railway Engineering Association. He is the only Canadian nominated for the Board of Directors for this year and efforts are being made to ensure his election in order that this country may be represented on the Association. Mr. U. E. Gillen, general manager of the Toronto Terminals Railway Co., is also a nominee for the Nominating Commttee of the Association. The results of the election will be announced at the 21st annual convention on March 17.

Obituary

Mr. C. C. Gillies, vice-president of the Frank A. Gillies Co., Ltd., contractors' supplies, Halifax, N.S., died recently.

Capt. D. Kyle, M.C., vice-president of the Algoma Steel Corporation, of Sault Ste. Marie, Ont., died recently of pneumonia.

Mr. Henry Walker, contractor, of Windsor, Ont., died recently in his 85th year, following a brief illness. Among the largest of Mr. Walker's undertakings in Windsor were, the Hotel Dieu, Victoria Block, and the Manning House.

ESTABLISHED 1886

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Immediate Action Needed To Reduce Canada's $2.90 Per Capita Fire Loss

RECORD-BREAKING, while a commendable enough procedure in some connections, is grossly misapplied when fire losses are concerned. In this regard, however, Canada seems year by year to be breaking new records, striving, to all appearances, to maintain its position at the top—or shall we preferably say, the bottom—of the list. The per capita fire loss in Canada is notoriously high—the highest in the world and, in spite of every attempt of propaganda to demonstrate the wantonness and wastefulness of our neglect and carelessness, this loss is not mitigated as the years go by. Even when the fire demon himself brings right home to us the loss of life, of employment, of created property, of material resources and of commercial prosperity, that follow in his wake, we scarcely heed, much less profit by the lesson. With twenty-three and a half millions gone up in smoke in 1919, we can hardly be said to be taking fire prevention ideas to heart. Putting it on a per capita basis, Canada has lost, through fire this past year, $2.90 for each man, woman and child. With this to its credit, Canada is a sorry sight beside Europe with its 71 cents per capita loss—a quarter as much.

Canada's fire wastage has indeed reached such alarming proportions that its reduction is one of the country's most vital and urgent problems. Effective measures for its control are demanded if any conservation of our national wealth and resources is to be secured. Fire waste is needless and definite action must be taken or the present tremendous loss of property and life cannot but vitally affect the economic future of the country.

The twenty-three and a half millions is but a partial representation of the real loss. The indirect loss, involving interrupted business relationships, loss of earnings by employees, loss to property owners, loss to municipalities through destruction of taxable values and the loss of human lives—this loss is beyond the power of figures adequately to represent. However, considering only the monetary loss, $2.90 per capita is an enormous drain upon the resources of the Dominion and demands some more adequate measures for its control.

Municipalities Get More Power Under Amended Quebec Housing Act

THE Quebec Government's scheme for erecting workmen's dwellings and providing garden cities has proved unworkable, and is to be discarded. The Government Housing Act contained clauses dealing with the loan of monies to various cities and towns, and also the class of house to be constructed. Under this act a technical commission was appointed, consisting of a director, architect, sanitary expert, and landscape architect. The commission, whose duties were to pass on all schemes, draw plans, and generally carry out the objects of the act, the expenses being met by a levy of 2½ per cent. on the amount of the loan to the town or city.

There were numerous applications for loans, but very little was done in the way of actually carrying out the act. The restrictions were found in practice to be very onerous, and Montreal in particular raised serious objections, not only to the tax imposed by the technical commission, but also to the regulations governing the class of houses to be built. To meet these objections, the Quebec Government has introduced an amending Bill, which alters the previous act very radically, and abolishes the technical commission.

In the place of the former machinery, the Government will simply allot the amount of the Federal grant to the municipalities, and leave to each municipality the absolute control of the construction of the dwellings and the full responsibility. The municipalities will in turn be able to make loans to individuals or housing companies. The Government are of the opinion that it will be an almost impossible task to look after the construction of houses in perhaps 100 or 200 cities and towns. They will, however, advance sums of money to the municipalities, in return for which the municipalities will give the Government its bonds at 5 per cent., taken at par.

Provision is made in the bill whereby the municipalities, for their greater protection, may have the land on which individuals are to construct houses transferred to the municipalities. The bill adds: "Such transfer may be made as a condition to a loan of money, providing the municipality agrees to re-convey the said lands and said buildings to the borrower when the latter shall have paid to the municipality twenty-five per cent. of the amount of the loan."

Provision is made whereby a municipality may appoint a commission to do the work for any length of time, and delegate to such commission all or part of its powers.

There is a clause affecting Montreal only, stating that in case Montreal appoints a commission, the acts of the latter do not require the approval of the Provincial Director of Housing.

The bill permits of the construction of a tenement consisting of three dwellings—the limit—at a total cost of $13,500. This was done at the request of the city of Montreal, which was not clear as to the definition of a dwelling under the law, and feared that it meant a self-contained house, or a semi-detached, not "flats." According to the Hon. W. Mitchell, the Federal interpretation of a dwelling permits of the tenement type of building, but to reassure Montreal the law is being amended.

The amendments to the act are designed to make schemes for working men's dwellings more simple in operation, the powers formerly exercised by the Government being delegated to the municipalities. The amount of red-tape will thus be reduced, and a more direct system, through the municipalities, adopted. The former plan was too rigid and complex, and involved regulations which, it was felt by many, did not make for the economical and expeditious construction of workmen's houses.

Legislation for Engineers Making Progress in Quebec and Nova Scotia

FOLLOWING up a meeting of a committee of the branches of the Engineering Institute of Canada, held last year in Montreal, at which the subject of the status of engineers was discussed, legislation is now being sought by provincial engineers who are members of the Institute.

The incorporation by provincial charter of the present members of the Engineering Institute of Canada, domiciled and practising in the Province of Quebec as "The Corporation of Professional Engineers of Quebec," has been approved by the committee of the Legislative Council. The body referred to will deal with the status of engineers.

At Halifax at a meeting of engineers, a provincial council, with president and vice-president, was selected to take office, after the passage by the Nova Scotia Legislature of the bill fixing the status of the engineering profession in the province, the council to carry on for not more than six months. The officers and council elected are: President, Mr. C. E. W. Dodwell, Halifax; vice-president, Mr. D. H. McDougall, New Glasgow; council, Messrs. J. L. Allan, Dartmouth; T. J. Brown, Sydney Mines; F. A. Bowman, Halifax; F. W. Doane, Halifax; A. F. Dyer, Halifax; F. R. Faulkner, Halifax; I. P. McNab, Halifax; W. G. Matheson, New Glasgow; W. P. Morrison, Dartmouth; C. M. O'Dell, Glace Bay; D. W. Robb, Amherst; J. W. Roland, Halifax; F. P. Sexton, Halifax; K. H. Smith, Halifax; L. H. Wheaton, Halifax. If this bill is passed, a new and permanent council will be appointed within six months.

Ontario Highway Department's Annual Conference of Road Superintendents

THE sixth annual Conference on Road Construction for County Road Superintendents and Engineers will be held at Parliament Buildings, Toronto, March 1st, 2nd and 3rd, 1920. This yearly conference is held under the auspices of the Ontario Department of Public Highways. The program follows:—

Monday, March 1st.—Morning Session—10 a.m., "Drainage," G. R. Marston, County Engineer of Norfolk. Discussion introduced by Chas. Talbot, County Engineer of Middlesex; J. G. Cameron, County Engineer of Stormont, Dundas and Glengarry. "Quarrying and Crushing," T. V. Anderson, County Road Superintendent of Lennox and Addington. Discussion introduced by R. H. Fair, County Road Superintendent of Frontenac; J. R. McQuigge, County Engineer of Renfrew.

Afternoon Session—2 p.m., address, Hon. F. S. Biggs, Minister of Public Works and Highways. "Mechanical Handling of Stone and Gravel," A. M. Jackson, County Engineer of Brant. Discussion introduced by J. F. Pineo, County Road Superintendent of Elgin; T. R. Allison, County Road Superintendent of Wentworth.

Tuesday, March 2nd.—Morning Session—9.30 a.m., "Bituminous Penetration Surfaces," A. B. Manson, City Engineer of Stratford. Discussion introduced by Peter Robertson, County Road Superintendent of Lincoln; F. A. Senecal, County Road Superintendent of Prescott and Russell. "Street Paving in Towns and Villages," E. A. James, Engineer to the Toronto and York Roads Commission. Discussion introduced by J. G. Mill, City Engineer of Belleville.

Afternoon Session—2 p.m., "Highway Laws." Open discussion, introduced by W. A. McLean, Deputy Minister of Highways of Ontario.

Wednesday, March 3rd.—Morning Session—9.30 a.m., "Time and Cost Keeping on County Roads," K. W. McKay, County Clerk of Elgin. Discussion introduced by D. W. McBurney, County Road Superintendent of Haldimand; D. J. Kean, County Engineer of Ontario. "Concrete Road Construction," H. E. Davis, Assistant Engineer, Department of Public Highways. Discussion introduced by W. G. McGeorge, County Engineer of Kent; J. F. Millen, Sandwich.

Afternoon Session—2 p.m., "Concrete Bridges and Culverts," Arthur Sedgwick, Assistant Engineer, Ontario Department of Public Highways. Discussion introduced by T. R. Patterson, County Engineer of Huron; J. M. Young, County Road Superintendent of Wellington. "Maintenance of Stone and Gravel Roads," William Watters, County Road Superintendent of Lanark. Discussion introduced by W. W. Brookfield, County Road Superintendent of Welland; H. G. Bleecker, County Road Superintendent of Hastings.

No. 12

Canada's Engineers—E. M. Proctor

The subject of the sketch in the "Canada's Engineers" section of this week's issue is E. M. Proctor, manager of the E. A. James Co., Ltd., consulting engineers, Toronto. Mr. Proctor was born in Sarnia, Ont., in the year 1888, and was educated at the Sarnia Collegiate Institute. In 1905 he entered the Faculty of Applied Science, University of Toronto, and obtained the degree of B.A.Sc., in 1909. During the summer of 1907 he was engaged as recorder on plane table and stadia survey for the Canadian Pacific Irrigation Company, Alberta, and the summer of 1908 was employed as leveller on final location work for the National Transcontinental Railway in Northern Ontario.

After graduation he was employed for nine months as resident engineer for Mr. Willis Chipman, on waterworks construction in Western Canada. For the next two years and a half he was with the Canada Foundry Company, now the Canadian Allis-Chalmers Company of Toronto, as structural detailer in connection with steel bridges and buildings. In 1912 he joined the bridge engineering staff of the Department of Railways and Bridges for the City of Toronto, being engaged on the design of many city bridges, including the following:—St. Clair Ave., Crawford Street, Olympic Island, Mount Pleasant Road, Strachan Ave. and the bridges in connection with the eastern entrance to the Exhibition; also designs for the replacement of the Rosedale bridges, which work has not yet been carried out.

In 1916 Mr. Proctor joined the staff of James, Loudon & Hertzberg, Limited, now the E. A. James Company, Limited, and within a few months was appointed manager of the company. Since then he has had direct charge of their engineering activities, the work upon which he has been personally associated, being of a varied nature, and including the following: Waterworks system, garbage incinerator and housing scheme at New Toronto, Ont.; water filtration plant at Weston, Ont.; pavements and storm sewers in Orillia, Strathroy, and Mimico, Ont.; garbage incinerator at Sarnia, Ont.; industrial buildings for the Mueller Metals, Port Huron, Mich., the Northern Rubber Co. and the Partridge Rubber Co., of Guelph, Ont., and the Bawden Machine Company, of Toronto; structural work of the Toronto Orthopaedic Hospital for the Department of Public Works, Ottawa. Consultations and reports upon municipal problems have also been conducted for the towns of Beaverton, Newmarket, Aurora, Campbellford, Richmond Hill, Scarboro Township, Acton, Milverton, Napanee, Seaforth, Forest, Port Dover, Chatham and Windsor.

Mr. E. M. Proctor

Mr. Proctor is an Associate Member of the Engineering Institute of Canada; Member of the American Society of Municipal Improvements; Member of the Engineers' Club, Toronto, and the Board of Trade, Toronto.

$30,000,000 for Quebec Roads Since 1912

Under a bill amending the Quebec Good Roads Act, the Government has power to borrow ten millions additional for the continuation of the good roads policy, making a total of $30,000,000 in all since 1912. The Government is authorized to pay up to six per cent. for this loan, instead of four and a half as heretofore, but the rate of interest charged the municipalities, three per cent., remains unchanged. Of the $20,000,000 spent under the Act only $5,000,000 has been actually borrowed, the remainder having been provided out of the consolidated revenue fund from the surpluses and other sources.

Uses for Waste Asbestos

Mr. J. H. Walsh, general manager of the Quebec Central Railway Company, draws attention to the enormous quantity of waste asbestos on the line. "Asbestos sand," when mixed with cement, makes a very solid and suitable block, of the kind used in building the company's stations. It is also used in making sheathing and asbestos building board. The waste sand from the dump can be had, he thinks, for the taking away of it, and the finer grade, called asbestos fibre D, at a very small cost, $4.00 to $8.00 a ton. The freight rate to Sherbrooke on this material is as follows: Sand in bags (value $10 per ton and under), 6 cents per 100 lbs., minimum 60,000 lbs; sand in bulk, 4½ cents per 100 lbs., minimum 60,000 lbs.. Mr. Walsh suggests that a suitable building could be obtained at East Broughton for the manufacture of blocks or beaver board.

Protection for B. C. Architects

With a view to putting an end to American architects practising in British Columbia, the architects of the province have a bill before the Legislature which provides incorporation for an architectural institute, and also protects Canadian architects. The clause which debars American architects from practising is as follows:—"An architect seeking admission under this Act, who is a citizen of a foreign country or state, shall be admitted to practise architecture in this province on passing such an examination as may be prescribed by the council; provided that such foreign country or state of which he is a citizen recognize the standards of qualification set out herein on an equal footing with their own, and admit the members of this institute equally with their own citizens."

Sewage System for Mowat Sanitorium Uses Imhoff Tank and Sprinkling Filter

Private Plant, Serving Hospital Buildings, Shows Clear Effluent — Chlorination to be Added

By A. Langlois, B A.Sc., C.E.*

THE Mowatt Sanatorium is situated in the town of Portsmouth, Ont., about three miles west of the city of Kingston. The hospital consists of a series of four large pavilions, one vocational building, one nurses' home, one orderlies' building and storehouse, six small cottages, a power house and a large central building, where are located the laboratories and offices, dining rooms and kitchens. The top storey of this main building is used for the bed patients of the more severe cases. The institution is well situated as a sanatorium—on top of a hill, the slopes of which are covered with fine trees, and which is at an elevation of 80 ft. above the level of Lake Ontario. The capacity of the hospital, which is at the present time under the administration of the Department of Soldiers Civil Re-establishment, is 300, including the staff.

The town of Portsmouth has no system of sewage disposal, each householder being individually responsible for his own. It was considered necessary, for the good of the inhabitants, as well as for the hospital itself, that the wastes coming from the hospital should be purified before they were discharged into the natural drains to Lake Ontario. After investigation and study of the situation, it was decided to install a sewage disposal plant that would have a highly clarified effluent.

Imhoff Tank, Sprinkling Filter and Sludge Bed

The plant decided upon consists of an Imhoff sedimentation tank with siphon chamber, a stone sprinkling filter and sludge bed. The system, as built, has been approved by the Ontario Board of Health with the recommendation that chlorination be added depending on the quality of the effluent. The system has been in operation since October, 1919, and is working as well as expected. It is quite noticeable that the effluent is becoming more and more clarified. However, to ensure greater safety, the Department of Public Works has decided to chlorinate and purify the water until it is absolutely inoffensive.

The size of the sewer pipe for the entire system is 6 inches, and although this may be a subject of discussion, it has proved to be sufficiently large to take care of the flow it is intended to carry. There are ten manholes on the sewer system with cleanouts consisting of three-quarter pipes opened for the full length of the manholes.

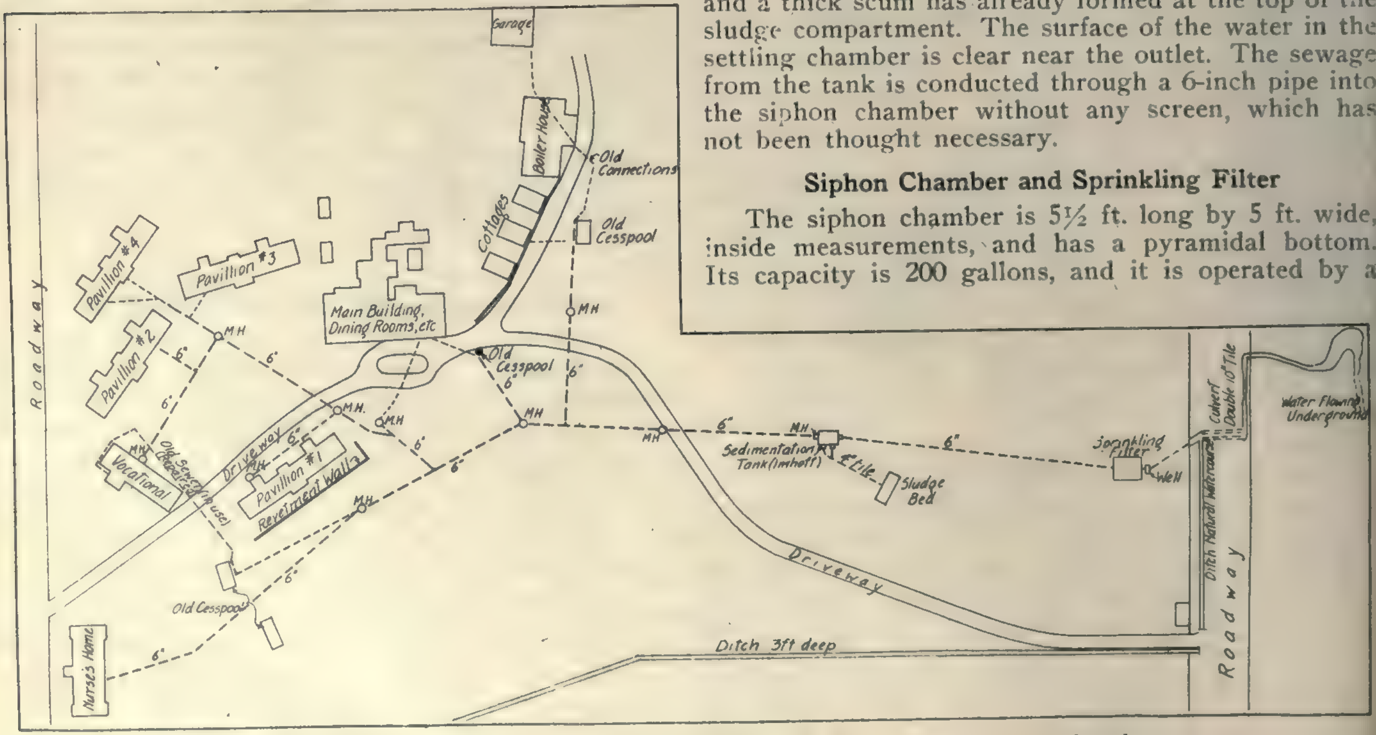
Sedimentation Tank

The sedimentation tank is of the Imhoff type, built of reinforced concrete. It measures 20 x 9 ft. in plan. The depth from the flow line to the bottom is 15 feet. The floor is divided into two sections, pitching to the centre in the form of a pyramid. The sludge compartment is so designed that the sludge can be stored for about 5 months. The period of retention is from 1½ to 3 hours. The sewage passes a baffle at the front end and one at the low end of the settling compartment. The effluent from the sedimentation tank is quite clear and free from suspended matter and the odor is hardly noticeable when the covers are open.

The plant has been in operation about four months and a thick scum has already formed at the top of the sludge compartment. The surface of the water in the settling chamber is clear near the outlet. The sewage from the tank is conducted through a 6-inch pipe into the siphon chamber without any screen, which has not been thought necessary.

Siphon Chamber and Sprinkling Filter

The siphon chamber is 5½ ft. long by 5 ft. wide, inside measurements, and has a pyramidal bottom. Its capacity is 200 gallons, and it is operated by a



Layout of Mowatt Sanitorium, Portsmouth, Ont., showing location of sewers and disposal works

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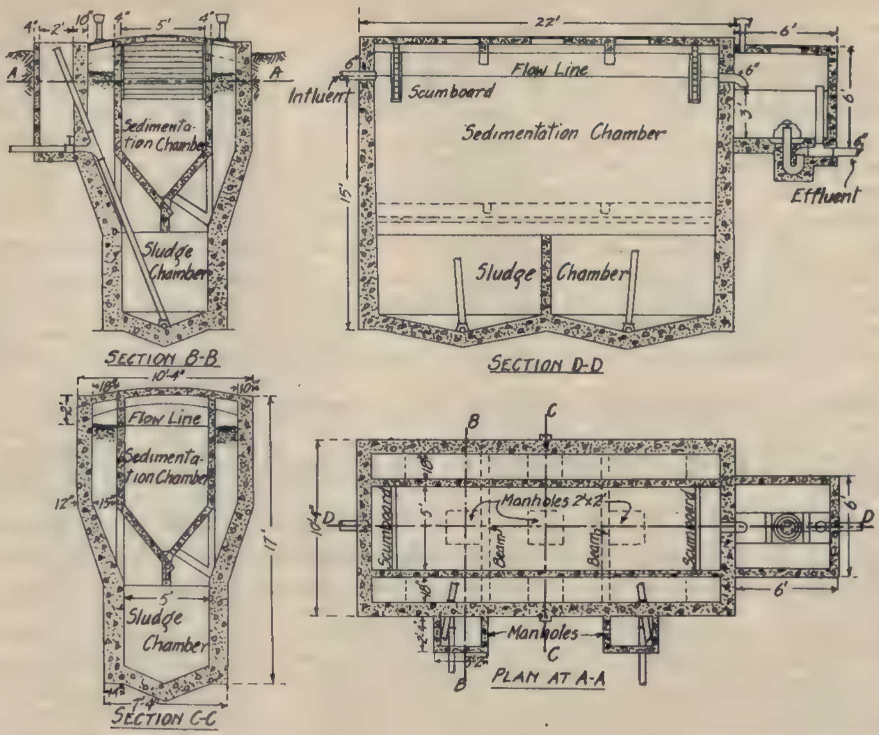
*Senior Assistant Engineer, Department of Public Works, Ottawa.



The sedimentation tank is of the Imhoff type, with floor divided into two sections. Period of retention is from 1½ to 8 hours.

5-inch Miller Siphon discharging into a 6 in. main carrier, leading to the sprinkling filter with a 7 ft. maximum head. The siphon chamber is made of reinforced concrete and forms part of the sedimentation tank.

The sprinkling filter is a reinforced structure, measuring 26 x 18 ft. inside. It is divided into two compartments longitudinally by a concrete wall to permit the cleaning of the filtering stone. The concrete floor has a fall of 2½ per cent. towards the chlorination tank, and upon it is laid the underdrains consisting of 5-in. half vitrified tiles resting in grooves. The sewage is directed to a gutter at the lower end of the filter, finally flowing into the chlorination compartment. The filtering stone measures about 5-in. for the first foot on top of the half drains, voids being partly filled with smaller size stone. The balance is a mixture of equal quantity of ½ and 1½ inch stone. The total depth of the filtering materials is 5 ft.

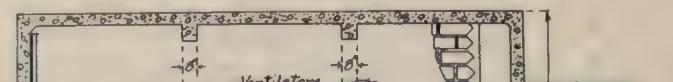
The sewage is brought to the nozzles through two 3-inch galvanized-iron distributing pipes branching off from a six-inch cast iron feed pipe controlled by two gate valves. The distributors are carried by 1½ inch rods embedded into the concrete floor and provided with iron saddles. At points of support, tees are placed to provide for the nozzles, six of which are used, three on each side. They are of the Taylor square spray type. Four ventilators give aeration to the filtering stone.

It was at first proposed to leave the filter in the open air, but in view of the intense cold weather of this part of the province it was thought advisable to erect a house over it to protect the nozzles from frost during the night, when for about eight hours there is practically no water coming from the hospital. An ordinary coal heater supplies the heat.

Samples of the effluent from the filter are being taken every two weeks for analysis. Reports of these tests are not available yet, but the quality of the effluent is improving to such an extent that it is almost clear and free from any odors and will, no doubt, become highly clarified.

Chlorination Basin and Sludge Bed

The chlorination tank will be part of the filter and consists of a well, 8 x 6 ft., with a depth of 3 feet.



Details of Sprinkling Filter

This part of the system is now under construction and will be in operation in a short time. An ordinary chloride of lime process will be employed. A secondary sedimentation basin may be established to provide for the settling of the humus matter which may come through the filtering stone. However this will depend on the quality of the effluent.

The sludge bed was excavated in the natural ground to a depth of four feet and made with natural sloped embankments. It has an area of 400 square feet and the depth of the filtering material is 3 feet. This material consists of a mixture of fine broken stone and gravel, covered with a 6-in. layer of sand. On the bottom were laid 3-inch field tiles placed 2 ft. apart. The sludge is carried to the drying bed through a vitrified clay pipe.

The cost of the entire system was $11,800, and includes the building of 2,600 lin. ft. of 6 in. sewer, 1,600 lin. ft. of ditch for surface water, and the building of the tanks, etc., as follows: 590 cu. yds. of rock excavation; 1,044 cu. yds. of earth excavation; 1,100 cu. yds. of back filling (earth and stone); hauling 275 cu. yds. of excavated rock 1,500 feet away; 2,600 lin. ft. of sewer trench, part 7 ft. deep in rock; 1,600 lin. ft. of trench 18 in. deep for surface water; 11 concrete manholes; the reinforced concrete tank and filter house and sludge bed. The excavation for septic tank, 18 ft. in depth, was in solid rock. In that cost of $11,800 is not included the salary of the engineer in charge.

The writer had charge of the design and the building of the system under the direction of Mr. S. J. Chapleau, C.E., district engineer.

Activities of Dominion Town Planning Branch

Report to Commission of Conservation Gives Account of Past Year's Accomplishments and This Year's Prospects

THE following account of the work of the Town Planning Branch of the Commission of Conservation for the past year was given by Mr. Adams before the Commission of Conservation at the eleventh annual meeting held in Montreal Feb. 18 to 20.

Legislation

An Act was drafted for Quebec Province which passed a first reading the last session and is still under consideration of the Government.

A special Draft was also prepared for revising the Ontario Act to meet the needs of the large cities and towns.

A draft Act was prepared for British Columbia and has been submitted to the Government.

Different sets of regulations under town planning legislation have been prepared or reviewed during the year. Provisions of St. John and Halifax Town Planning schemes have been revised and are now about ready for presentation to the provincial governments.

Proposals have been made to the cities of Edmonton, Calgary, Lethbridge and Medicine Hat as to the special provision necessary to deal with their somewhat unique conditions under town planning schemes.

Housing Legislation and Administration

Under the Order in Council of 12th December last the Town Planning Adviser of the Commission was asked to give assistance and co-operation to the Housing Committee of the Cabinet to carry on the work of the Committee in administering the housing loan of $25,000,000 granted under the general housing project of the Federal Government. A large part of the time during the past year has been given to this work with the assistance of a special staff appointed by the Housing Committee of the Cabinet.

General Town Planning Schemes

General advice has been given to the cities all over the country in connection with proposals to prepare town planning schemes. Meetings have been held or visits paid to cities in all the provinces. Considerable progress has been made with plans for several cities, including St. John, Halifax, Borden (P.E.I.), Hamilton, London, Ottawa, Calgary and other smaller cities.

A housing report has been advanced towards the stage of being nearly ready for publication and a report on regional planning was completed. A report on industrial decentralization in large cities is under preparation, after a considerable amount of research in Toronto and Montreal by Captain Ferguson, M.E.I.C.

Reports have also been prepared on the surveying of curves by Mr. H. L. Seymour, A.M.E.I.C., and on comparative conditions of assessment and taxation in different cities by Mr. A. G. Dalzell, A.M.E.I.C., and on several incidental questions such as sunlight engineering.

Plans for different cities and housing schemes have involved preliminary study of underlying factors.

Educational Work

Meetings have been held in numerous cities and several papers have been prepared for conferences. The Branch continues to lend slides and typewritten lectures and to prepare material for many publications, including "Conservation of Life."

Expert Advice to Government Departments

During the past year the Town Planning Adviser has been acting in an advisory capacity to the Department of Public Works in connection with the planning of the sites for public buildings in Ottawa and in respect of other matters.

In connection with the Housing Committee of the Cabinet a number of designs for houses have been prepared by Mr. W. D. Cromarty and Mr. B. Evan-Parry including a special design for soldiers suffering from tuberculosis and one for a farm house for the Soldiers' Settlement Board.

The Town Planning Adviser has also reported on the question of erecting wooden houses in England to the Department of Trade and Commerce.

Consideration has been given to the preparation of aerial maps of cities and towns, of topographical maps by Government departments.

General Correspondence and Advisory Work

Correspondence has been received from all parts of Canada and from Government and other departments in United States, Australia, England, Holland, Central Africa and elsewhere regarding town planning legislation and schemes. This part of the work continues to increase and make a large demand on the staff of the office.

WORK FOR THE PRESENT YEAR

Legislation

Town planning covers a continually extending field of work because of the large number of elements that enter into the growth of cities and towns and the new factors that are constantly arising. Hence, it is necessary to keep legislation up to date and to confer with the provinces regarding improvements and amendments needed.

Apart from Ontario, Quebec and British Columbia, we have up-to-date legislation in Canada but in the three provinces named negotiations must be continued to get proper town planning Acts on the statute books. The Quebec Government still have the matter under consideration and continued effort is necessary. The Branch is co-operating with the members of the Government and last year the Act passed its first reading. Now that the war is over there is more interest being taken in the matter and any delay is due to lack of time on the part of the Government and not to lack of conviction of the desirability of town planning. In Ontario there is a Town Planning and Development Act but it is not satisfactory to the municipalities. The Branch is acting in co-operation with the Government with a view to getting the Act amended and enlarged in scope. Even if this is accomplished in the coming session there will be a good deal of work to be done during the year in preparation of the necessary regulations. It is possible, however, that, owing to the Government of Ontario being new in office, it may be next session before the Act is improved along the lines being advocated. In British Columbia it is necessary to continue negotiations with the Government as we have not yet obtained legislation in that province. In the other provinces, while we have the legislation, we have to continue to advocate for its effective administration and to give assistance in drafting regulations and advising municipalities.

In all this work the Branch is acting in co-operation with the provincial governments.

Expert Advice to Government Departments and Municipalities

The activities of this Branch are continually being widened owing to the demands of different departments of the Federal Government, the Provincial Governments, and municipalities, for assistance in dealing with town planning problems. Advice is likely to be required in the coming year in connection with Federal departments as follows:—

Department of Public Health—Administration of Federal Housing Project.

Department of the Interior—Planning of Jasper and other townsites; also regional planning of areas in connection with water power developments.

Department of Public Works—Co-operation in planning of site of Government Buildings in Ottawa with the consulting architect and chief architect of the Department.

In co-operation with the Provincial Governments the Branch has been assisting and will continue to assist in the preparation of plans for Greater Halifax, St. John (N.B.), Borden (P.E.I.), and other cities.

The requests received from municipalities for assistance in preparing town planning schemes are very numerous. The whole of the time of a much larger staff could be employed if compliance were to be made with all these requests.

Studies and Investigations on Housing and Town Planning Conditions

The investigations which have been begun this year by Captain Ferguson into the industrial developments of the largest cities in the country will be completed and the tendencies towards industrial decentralization should be continued. These investigations will provide us with valuable information regarding the direction in which population is becoming distributed and regarding the factors which are causing industries to move from one district to another.

The Branch is also continuing investigations into the housing problem which has taken up a considerable part of the time during the past three years. It presents such great difficulties and complexities as to require continuous study. The problem is not now confined to bad conditions in the big cities but to shortage of good houses in all cities and towns and a need for improvement in the methods of planning and construction.

A leading part has been taken in promoting a movement to develop regional plans for industrial areas such as the area comprised in the Niagara district which centres round the power development of Niagara Falls. This movement is involving a good deal of research work and is already leading to good results and widespread interest.

Reports and papers will have to be prepared to meet part of the great demand which the Branch has for information, articles, papers for conferences, etc.

The Branch has been co-operating, and will require to continue to co-operate with the universities and the Town Planning Institute, in developing education in town planning.

Other research work during the coming year will include further investigation into assessment and taxation, particularly in the western cities where acute problems are arising in connection with these matters.

Work has to be limited to giving general advice, to carrying on educational work in some of the leading municipalities and to advising, as to the procedure which should be followed. Help may have to be given during the coming year to the cities of Hamilton, Border Cities, London, Peterborough, and several western cities. As the Branch has no direct responsibility in advising municipalities and can only do so with the approval of the province, efforts have to be confined to general advice and education. This work will keep the Branch fully employed during the year, along with the work connected with legislation.

Expert Advice in Connection with Development of New Towns

This work must in future be confined to correspondence and reports on general principles. The detail planning of new developments should be left to those engaged in special work as it is impossible for this Branch to undertake more than has already been done in this way of planning one or two examples, such as the Kipawa scheme.

It is also desirable to encourage professional practice in town planning so as to gradually build up a skilled profession in the country, capable of dealing with the immense problems and numerous schemes in the future.

Canadian Marble Resources Being Neglected

Author Claims That This Country Can Produce Architectural and Ornamental Stone Equal to Any Foreign Product

By W. H. Matthews*

THE prediction made at the recent convention of Provincial (Ont.) Builders' and Supply Association, that Canada is on the eve of a building boom, recalls forcibly the lamentable fact that we in Canada have neglected in the past to develop our wonderful natural resources for the supply of raw material in a department which is one of the most essential and important in the building trade. The reference is to Canadian building stone, particularly architectural and ornamental stone.

Considering the natural resources of the country, the Canadian stone industry has been sorely neglected, but there are vital reasons why this industry should now and without delay be stabilized. The conditions of foreign exchange figuratively says that, in spite of our great natural resources, our dollar is not worth its full value. Why? Because we as a nation are not equalizing our national resources; we are concentrating on the development of a few and neglecting other natural industries of which the Canadian stone industry is one, one which can help the country substantially in equalizing its imports and exports. Changes in world conditions are automatically forcing upon this industry a glorious future, but what are we doing on our part? The exchange question may be eliminated in a reasonable time by equalizing the trade values, but that will not eliminate the necessity of fostering our home industries and our natural resources.

The labor question which is playing such a big part in forcing up the values of some of our natural resources, particularly our marbles, is almost certain to be permanent. In foreign countries it may be possible for them to reduce their local labor cost enabling them to prepare raw materials for shipment more cheaply than we can, but this relatively small item does not compare with transportation costs where the shorter haul of our material gives us a very decided advantage. This is not only a decided but a sure advantage for some years to come as the hold labor has on transportation costs is undoubtedly firm.

Develop Our Own Resources

It is essential that these opportunities which have been thrown our way should be taken advantage of by coupling them with our undeveloped resources. With the aid of the press and our governments the facts relating to the building stone industry can be presented to the public in such a way as to assist in securing the necessary capital which, with proper management and co-operation among the different owners, should develop this industry so as to eliminate the necessity of importing. This would minimize, for the prospective builder, two vexing questions, exchange and the necessity of importing ornamental building stone. These questions are two of the principal causes of retarding the erection of the larger and more important projected buildings throughout the Dominion.

It may be well to bear in mind that in the past most of the stone entering into the construction of many of the larger and more important buildings throughout the Dominion was imported, with its equal in every way, and in many cases its superior, resting at home not quarried. It is not generally known that Canada is so fortunate as to have, in Hastings County, Ontario, vast deposits of ornamental stone, or marble as it is more commonly called, which have been pronounced as being second to none of the best offerings of the world's ornamental stone markets, by experts who have seen and examined them. From these deposits the replicas of most of the foreign marbles can be obtained, duplicating in every way their quality, color, texture, and strength.

Canadian Stones Not Inferior

Dr. Parks in his report to the Dominion Government, entitled "Ornamental Building Stone," especially mentions this area and the features of this marble in comparison with the imported marbles. He calls the attention of Canadian architects to the possibilities of the Bancroft marbles for interior and exterior building purposes, analyses showing that the strength and low absorption as well as the non-staining qualities of this stone, make our domestic product by far a more desirable and pleasing marble.

Dr. Parks in this report advises the Canadian architect to investigate the wonderful possibilities to be derived architecturally from the application and use of the ornamental and building stones of Hastings County.

No true Canadian would doubt our own ability to operate our industries under proper working conditions equally as well as our foreign competitors. Therefore the adaptability of the natural resources must contribute the means of economic production and distribution of the product in marketable form and in such a way as to not only meet our competitors but to sell low enough to eliminate them as keen contenders.

Adaptabilities of Canadian Resources

The natural adaptabilities of the Hastings County areas are exceptional when viewed from a commercial standpoint. The strata from which these marbles are quarried are compactly grouped in a wonderful assortment of varieties, white, colored, bread and butter, monotone and variegated. There are sources of ample water power which when developed should reduce the production costs to the most economic basis. Economy in shipping is another essential feature in low cost of production and this is already assured in this area by the location through the quarries of a line of the Canadian National Railways.

The same general advantages are found in another grouping of excellent stone quarries, capable of supplying stone of an entirely different formation yet essentially of great value to the building trade. The writer refers to the Peel County group which supplied the stone entering into the construction of the facade of our Ontario Parliament buildings, a stone acknowledged to be at the very top of its own classification.

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*Manager, Canadian Marble Company, Limited, Toronto.

The writer understands that an effort is being made to group under one management some of the properties in Hastings County; this is a move in the right direction. In so far as our ornamental building quarries are concerned, if they were grouped in their own classification for economy in sales or grouped in location for economy in production, and organized under some system of controllable co-operation as an industry, it would go a long way towards wiping out our heretofore keen foreign competition. Such an industry, with its wealth of natural resources in architectural and ornamental stones which are in many cases superior to the foreign, should under proper business management soon develop into an exporting industry.

Our Governments, public utilities, and large financial institutions, erect magnificent edifices in which to conduct their business. In these edifices the architectural ornamentation is not necessary for the carrying on of the business but is added as a matter of national pride and to emphasize our national strength, figuratively speaking "They build of masonry the pages of our National advertising." Then let us as a nation see that this industry becomes a national one, so that our future advertising may be truly National, MADE IN CANADA.

Ontario Land Surveyors Hold Convention

Report of Proceedings—Papers on Surveying Topics—Highway Development Given Considerable Attention

THE opening meeting of the twenty-eighth annual convention of the Association of Ontario Land Surveyors was held in the Engineers' Club, Toronto, Tuesday afternoon, Feb. 17. After the reading of the minutes of the last meeting and the disposal of other formal business, the association's president, Mr. C. Fraser Aylsworth, delivered an address, dealing with the importance of organization among land surveyors to protect their interests, and endorsing a Dominion wide association. Next in order came the reports of the different business committees, read by the respective chairmen. Mr. E. Deville's paper on "Boundary Monuments" was read by the secretary, Mr. L. V. Rorke, owing to the absence of Mr. Deville. Considerable discussion took place on a question which was raised regarding the formation of a Dominion Land Surveyors' Association, the outcome of which was the appointment of a committee, composed of Col. Van Nostrand, J. A. Dobie and C. F. Aylsworth, to confer with committees from other associations interested and report at the next meeting.

The evening session was opened by the reading of a paper on "Possibilities of the Aeroplane in Connection with Surveying," by Lt.-Col. R. Leckie, of the Canadian Air Board, which was illustrated by several lantern slides of actual photographs taken from aeroplanes. Mr. H. L. Seymour, of the Commission of Conservation, Ottawa, next read a very interesting paper dealing with the subject of "Housing and Town Planning," which brought the evening session to a close.

Wednesday Morning Session

The first item of business of the Wednesday morning session was the reading of the report of the Committee on Roads and Pavements by its chairman, Mr. George Hogarth. After a short discussion on the contents of the report, a move that same be adopted was carried. The question of the advantage of the motor truck for hauling materials was raised at this point and Mr. Hogarth pointed out that in certain seasons of the year, when the roads were in a bad condition, it was next to impossible to use trucks for this purpose, but was of the opinion that under favorable conditions the truck was superior for hauling materials. In comparing the truck to the tractor, Mr. Hogarth favored the truck on account of its greater speed and reliability of operation.

Provincial Highway Work

Next on the program was Mr. Hogarth's illustrated talk on "Provincial Highway Work." The speaker first touched upon the location of the main branches comprising the province of Ontario's road system and explained the standard adopted for road layout with reference to overall width, allowances for ditches, etc.

Many before and after views were shown, depicting the bad conditions existing on various roads throughout the province owing to the lack of proper drainage facilities and the measures taken by the Department of Highways to correct this. An illustration of the danger sign being used on highways which are crossed by railway lines was shown. This sign is placed at a distance of about 300 ft. from the open crossing, warning vehicles of the danger spot ahead. Mr. Hogarth stated that by spring, this year, the department expected to have placed these danger signs near every crossing in the province. A number of interesting slides dealing with the elimination of sharp curves, grading, hill cutting, the excavation of ditches, the department's road building machinery in operation, stone crushing plant, bridges and culverts constructed, etc., were also shown. Mr. Empey, also of the Ontario Highway Department, gave a short talk, also illustrated by lantern slides, on the work done on the Ottawa-Prescott branch of the Provincial Highway. Owing to the great amount of rock encountered in the construction of the foundation of this road, a machine for removing boulders was installed, and in some cases blasting was necessary. Towards the end of Mr. Empey's talk, he read a summary of the work that had been carried out on this particular branch of the Provincial highway, which covered the following: 12-1/3 miles of ditch filled in with rock to bring the road to a 30-ft. width; 2½ miles of macadam completed; 5-1/10 miles grading about half completed; 27-6/10 miles grading completed; considerable area near Ottawa on which grading has been completed and macadam surface laid. A vote of thanks was moved by Mr. Speight and seconded by Mr. Gibson, to Mr. Hogarth and Mr.

Empey, and unanimously responded to by the members.

The Wednesday afternoon session included a paper on "Highway Drainage" by Mr. U. V. Christie, which pointed out the important bearing proper drainage had upon the life of the road. The report of the Council of Management and Board of Examiners was read by Mr. T. B. Speight, and that of the Committee on Drainage by Mr. W. G. McGeorge. The report of the Committee on Repository and Biography was also presented.

The election of officers and nominations for members of council were the important items of business on the program for the final day of the convention. The new officers elected were: President, T. B. LeMay, Toronto; vice-president, G. A. McCubbin, Chatham; secretary-treasurer, L. V. Rorke (reappointed); auditors, John Van Nostrand and D. D. James; scrutineers, A. T. Ward and H. L. Esten. Two members will be elected to the council and the following were nominated for the vacancies: F. N. Rutherford, St. Catharines; J. W. Pierce, Ottawa; H. M. Anderson, North Bay; W. G. McGeorge, Chatham; J. J. MacKay, Hamilton; J. D. Evans, Trenton, and E. D. Bolton, Listowel.

A luncheon in the afternoon, tendered to veteran surveyors who have been in actual practice for 30 years or more, was the closing event of a very successful convention.

Minter System of Burning Clay Ware Gives Excellent Results*

By D. C. Merkley

FOR a number of years we have been interested in clay working and plant operation. We visited a number of plants and naturally looked into every phase of operation wherever opportunity offered. We always found round down-draft kilns producing results, and decided that it was the type of kiln best suited to variable requirements and the production of the very best quality of ware. The cost of burning ware in round down-draft kilns has always been high, and this fact led us to investigate a system known as the Minter System. The writer made a special trip to the plant of The Flint River Brick Company, Albany, Ga. They had had the system in use for more than two years, and the results optained as proven by their records, the burned ware on hand, and the actual operation, were noted very carefully.

I was convinced that the claims for this system were conservative and were based on actual performance. After fully investigating the Minter system we entered into a contract for a battery of kilns, and Mr. Minter came to Ottawa and supervised the construction of these kilns. We used the best material and construction methods and believe we have a battery of kilns that embody everything known in kiln construction and operation of this type of kiln at the time they were constructed.

System is Flexible

The flexibility of the system is remarkable by reason of the fact that just as good ware is produced when operations are temporarily interrupted as when the operation is continuous.

The flue system is designed to do any one of three things; to discharge from kilns to (1) induction; (2) to waste heat flue; (3) to the next kiln ahead of burning kiln and in each burn each flue is used at some stage of the burning process.

The draft is produced by a multiblade fan and 25 h.p. motor, and is directed from kiln to kiln and from flue to flue by almost air-tight dampers. The damper can be regulated to give instantly just the draft desired, according to the stage of the burn through which the kiln is passing and the kiln atmosphere required.

Control of the distribution is by a series of flues and openings built in and require no regulation whatever in operation—the only necessary attention being to remove any obstruction that may get into them, and this can be done from the outside. The continuous principle is carried through the regular cycle of operation, with No. 1 kiln cooling and furnishing waste heat for watersmoking No. 4 kiln, or to the drier or to both the drier and watersmoking kiln, No. 2 kiln previously pre-heated from No. 1 under full fire and the draft from No. 2 passing through No. 3 and thence to induction.

While in full operation there is one cooling kiln, one firing, one pre-heating, and one watersmoking kiln, the draft on four kilns, and only one kiln under fire. We use one day and one night fireman. We find that in using waste heat from the kilns for the drier that the amount of fuel required for the kiln would be used in the boiler if steam was run through coils to dry an amount of ware equal to what we dry with the waste heat from the kiln.

Improvement in Quality of Ware

Waste heat is the cheapest source of heat possible for use so far, and the result of the use of the system at our plant has been, as stated above, very cheap in operation, easy to control, and altogether satisfactory. There was a great improvement in the quality of the ware over our old method of burning. We began operating the kilns in the fall of last year.

Some of the kilns and flues were wet on the last burn around just before we closed down for the winter, and the weather was cold, near zero, for portion of the time. We burned five kilns holding a total of 520,000 brick with 135 tons of coal, or 520 lbs. per 1000. The brick were well burned and 85 per cent. were face brick and sold as such.

In addition to burning the brick the waste heat was used to dry about 75 in our waste heat drier. We are making a mixed product, common brick, face brick, terra cotta, and hollow ware of various sizes. Our kilns are adapted to the manufacture of a mixed product. Our operation is practically smokeless.

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*Paper read before Canadian National Clay Products Association.

The Sterling Engine Company, of Buffalo, N. Y., have issued a pamphlet describing the model G-R Sterling engine. This series comprises 4, 6 and 8 cylinder engines, of the dual-valve-in-the-head type, ranging in power up to 300 h.p. These engines have been developed from previous models and are not a radical departure from Sterling practice. A detachable cylinder head containing overhead dual inlet and dual exhaust valves has been added, in addition to which various bearing surfaces have been increased. Other refinements have also been incorporated in the design. Complete specifications with prices are given in the folder. These engines will soon be available up to 450 h.p.

General Features of Bituminous Roads

Light Bituminous, Bituminous Macadam and Concrete, and Sheet Asphalt Explained in Paper Before Toronto Branch, E. I. C.

By Bruce Aldrich*

IN recent years the tremendous increase of automobile and truck traffic has caused the engineers in charge of county and small town roads and streets much worry. Roads which stood up well under horse drawn traffic, rapidly disintegrated and became a burden to the ratepayers on account of enormous maintenance costs.

Engineers and others soon began to look for some means to arrest the disintegration of their roads and to bring down the maintenance charges. Bituminous roads of various types were brought out with varying success depending on the materials and the manner in which they were constructed. Light bituminous materials were tried with the idea of overcoming the dust nuisance and preventing disintegration of the surfaces.

Surface treatment should be applied as soon as the road surface has hardened or set to a point where sweeping will remove all dust and the surface present a hard mosaic appearance. In new construction it is frequently advisable to apply the bituminous materials before opening the road to traffic. After application the road should be kept closed for about 36 hours, in order that the bitumen may penetrate the surface before it is disturbed and also to allow any excess of volatile constituents to evaporate.

Many engineers believe in giving two applications of light material the same year, one in the early spring and another in the fall, followed by an application of heavier materials the next spring; after making this last application very coarse sand or ⅜ to ⅝ inch chips are spread, which after being ironed into the surface by traffic, gives the surface the appearance of a bituminous concrete road. In making this last application it is necessary that no pools of bituminous material are left on the road or that a greater amount of stone or sand is used in these places with the idea of drying up the excess of bitumen (the excess of bitumen should be swept off the road) as these conditions are the cause for the surface "pushing" under traffic.

Before applying bituminous materials to old macadam surfaces or retreating roads which have had one or more applications, care must be taken in repairing holes or ruts. These must be thoroughly cleaned, all loose stone removed and new material tamped in, first well painting the bottom of the holes with the material which is to be applied to the surfaces or with a mixture of sand and stone and a cold patch material.

Bituminous Macadam

The bituminous macadam pavements, another type used most entensively since the advent of motor traffic, have a wearing course of macadam coated with asphalt or tar by the penetration method and usually laid on a stone foundation though often on concrete or on old macadam surfaces.

In the construction of bituminous macadam roads, too much care cannot be taken in the preparation of the foundation, as defects in workmanship very rapidly show in the surface of these pavements. In placing the stone for the foundation, it is customary to spread it by hand, but mechanical spreaders are often used successfully. When spreading stone by hand, the stone should be dumped along the road sufficiently far apart in order that all the stone be shovelled ahead, as the practice of dumping stone where it is required and merely levelling it out results in segregation of the finer material and prevents proper penetration of the binding material; also the stone in the centre of the piles receives a greater compaction than that which has been spread around it, causing an uneven foundation which unevenness will be duplicated in the wearing surface after the road has been subjected to traffic.

After the base has been consolidated, the stone for the wearing course is spread, generally to a depth of three or four inches. This is rolled, but only sufficiently to compact the stone to the contour of the road and bring out any irregularities which may develop, as an excessive amount of rolling at this time is likely to break up the stone and fill the voids with small fragments, thereby preventing the penetration of the binding medium.

The application of the bituminous material should be made as soon as possible after the initial rolling of the wearing course. This is usually applied by a distributor, using a pressure of about 35 pounds though where a distributor is not available, it is done by means of hand pouring cans. This latter method is not likely to produce the best results unless the maximum sized stone is used, the material heated to its maximum permissible temperature and the work done in warm weather.

Immediately after the application of the binding materials, ¾ to 1 inch clean stone should be spread at about 35 to 40 pounds to the square yard. The road is then rolled after which it is swept in order to remove any excess of ¾ inch stone or fine material.

The seal coat is then applied at the rate of not more than one-half gallon to the square yard. Coarse sand is then spread uniformly over the seal coat. Rolling is continued until the surface is smooth and uniform.

In the construction of many of the earlier bituminous macadam roads by the penetration method, it would appear that "waving" or "corrugation" of the surface was caused by the use of excessive amounts of binding materials, the use of too soft a material or inferior construction of foundations.

This type of pavement is one that has gained popularity in recent years, by reason of its simplicity of construction, long life, cheapness and ease with which it is repaired. The American Society of Civil Engineers define a bituminous concrete pavement as follows: "A bituminous concrete pavement is one having a wearing course composed of stone, gravel, sand or slag, or a combination thereof, and bituminous material incorporated by mixing methods."

The binding materials used in the construction of bituminous concrete pavements are asphalts, water, gas tars and coal tars.

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*District Engineer, the Asphalt Association.

Under the heading of bituminous concrete are a large number of different pavements which have been used and have given excellent results. Among those more commonly used are the "Bitulithic," "Warrenite," "Amiesite," "Topeka," "Filbertine," "Bitoslag" and what is termed "the Open Mix Specification." The principal differences in the specifications is the character of the mineral aggregate and the class of bituminous material entering into the composition of the wearing surface.

In new construction, bituminous concrete is laid on either cement, concrete or broken stone foundation. A cement concrete foundation six inches thick, composed of a 1-3-6 mixture is recommended for very heavy traffic; broken stone for suburban, or lighter traffic; a Telford foundation is recommended in low flat country where drainage is poor.

In resurfacing the macadam roads, bituminous concrete has proven very satisfactory; for worn out brick and concrete streets, it is the most satisfactory remedy. The method generally used for resurfacing old brick or concrete surfaces, is to first thoroughly clean the surface of the old pavement, then fill all holes or depressions with bituminous, or cement concrete, bringing the surface to an even grade. A two or three inch wearing surface is then laid.

Some engineers give the old surfaces a coat of bituminous paint before laying the new wearing surface. The paint coat should be applied with great care as an excess will soften the mixture and cause it to "roll" or "push" under traffic. Resurfacing of this type can be done at about half the cost of the original pavements, the results being, in most cases, very satisfactory.

There are a number of different types of asphalt plants with which various kinds of mineral aggregate may be economically heated and mixed with bituminous materials. Among these are the stationary, railroad and portable road plants. There are also a number of types of cement concrete mixers fitted with heating attachments which are largely used in preparing the "open mix" specification mixture.

The surface mixture should be brought to the road or street at a temperature between 275 degrees F. and 250 degrees F. If necessary to retain temperature in transit from plant to street, canvas covers should be provided for the trucks or wagons in which the mixture is hauled. In no case should it be laid on a wet or damp surface, or when the air temperature is below 35 degrees F. as it will cool so rapidly that proper compression will not be obtained when rolled. It should be uniformly spread by means of hot iron rakes in such manner that after having received its final compression by rolling the finished pavement conforming to the proper grade and crown, will have a thickness of not less than two inches. It is important in the spreading of the wearing surface to see that the mixture is completely loosened up and spread evenly with rakes before the use of the roller is permitted.

Waviness in a surface is often caused by insufficient raking of the hot material; no lumps should remain. No workman should be allowed to walk or place his foot in the hot mixture for the purpose of reaching out to correct some defect; depressions thus made will be filled by the raker causing more material at these points than elsewhere, resulting in unequal compression. Extreme care should be taken in spreading the mixture

The rolling and compression of bituminous concrete surfaces require a skillful workman, but the best man cannot secure the proper results if the surface mixture has not been properly spread by the rakers. Initial compression is best effected by a roller weighing about two and one-half tons and final compression by a roller weighing at least eight tons. The amount of transverse rolling should be equal to the longitudinal rolling.

All material that cannot be compressed by the roller should be well tamped with hot iron tampers. Smoothing irons should never be used unless handled by experienced men as they often burn the surface causing it to disintegrate.

Immediately after the wearing surface has been compacted, and while the surface is clean and dry, the seal coat of about one-quarter gallon to the square yard of hot asphaltic, is spread uniformly over the surface. On this is spread clean dry stone chips from ¼ to ½ inch in size; the surface is again thoroughly rolled and the street opened to traffic. In using the finer mixture the seal coat is often left off and the wearing surface swept with a small amount of portland cement.

The most important factors in securing the best results in bituminous concrete pavements are as follows:

1. Use the best materials available.
2. The proper grading of the mineral aggregate.
3. Using the proper consistency of the asphalt cement and determining the right amount of bitumen in order that the mixture is not too lean nor too rich.
4. Proper and thorough mixing at the plant.
5. Care in raking and rolling.

The sheet asphalt pavement is one having a wearing course composed of a carefully graded sand limestone dust or portland cement and asphalt cement mechanically combined. This is usually called "topping". This mixture is almost always laid on an intermediate course called "binder" of which there are two kinds, "open" and "close". The former consists of stone usually from 1½ to ¼ inches in size; coated with asphalt cement; the latter, which is largely used to-day, is composed of stone similar to that used in the "open" binder and sand usually in proportions of 75% stone, 25% sand. This, when mixed with asphalt cement, produces a bituminous concrete which is more impressive and offers greater resistance to displacement than the "open" binder.

Both the binder and the topping of the Sheet Asphalt pavement are prepared at a paving plant similar to those used in the manufacture of bituminous concrete, from which they are carried directly to the site of work and laid and compacted while hot. They should be delivered on the work at such temperatures that they may be readily spread and the loads should never be dumped in place but should be shovelled from piles. Each pile should be shovelled from the bottom and the mix deposited upon the road preferably by turning the shovel completely over. It is then spread by means of hot rakes to such a thickness as, after compaction, will produce the specified thickness for that particular course. The rakers should not stand on the hot mix more than absolutely necessary.

Each course should be compacted by rolling while hot, and as soon as possible after spreading and raking. Initial compaction is sometimes secured by the use of a three to five ton tandem roller and final compaction with a heavier roller, usually seven to eight tons in weight. To prevent the mix from adhering to the wheels of the roller, they should be mopped with kerosene and water during the rolling operation. Places which cannot be reached by a roller should be compacted and finished with hot tampers and in the case of topping, with smoothers. Smoothing irons, however, should be used only when absolutely necessary as without great care burning or blistering the surface may result. Rolling should be conducted as continuously as possible to avoid unnecessary formation of joints. It is very important that the binder be well compacted and all binder that shows lack of bond or which may become broken up before it is covered with topping should be removed and replaced with good material. No more should be laid at any one time than can be covered by the day's run of paving plant on topping. As soon as possible, after the binder is laid and preferably while still warm, it should be covered with topping in order to effect the most thorough bond between the two. The binder should be kept clean and as free from traffic as possible under working conditions.

Competition the True Basis of Successful Contracting

By James O. Heyworth*

TAKING advantage of extraordinary conditions the last few years, much has been written, said and advertised by experienced and reliable authorities advocating the many advantages to employer and employee through cost plus fixed profit or percentage contracts in construction work.

The situation may be summarized as follows:

1st. There is no argument or question but that there is an advantage to the employee or contractor.

2nd. Speed in execution of work is seldom if ever obtained by executing a contract before plans and specifications are ready, although this is the argument commonly used with the layman.

3rd. The advantage to the employer is at best theoretical and is substantiated only by the talk of the salesman.

Why?

Because it robs the employer of the ingenuity of several minds and organizations in competition; it robs him of the opportunity to obtain a contractor who has an experienced and successful organization which needs work to hold together what has taken years to develop; it robs the contractor of the opportunity to place a premium on efficiency, ingenuity, long hours, sacrifice and success.

What contractor could intelligently bid on a job unless he had men, in whom he placed confidence, at hand to put in charge of the job? It is an indefensible position for a firm to send one engineer or superintendent to a locality and start a job, employing all foremen and mechanics locally.

The cost plus a profit contract removes from a job the only standard by which success can be measured. By so removing this standard, it automatically kills the pride and satisfaction of the human being. What nation ever won a war with an army of hirelings? History has plenty of examples of such methods.

Satisfaction Not Measured by the Dollar

My experience has been that there is the highest type of loyalty, efficiency, sacrifice and citizenship in the men who really do the construction work of the country. They are as much interested in a job as is their boss, provided they have any real reason for this interest.

Ambition, satisfaction and contentment are never measured entirely and completely by the dollar.

Show me the man who at night comes into his home with the flush of success on his face; with the pride of achievement in his whole bearing; with the confidence and poise of contentment stamped on his brow; and I know the world will say he is a real success. This man would never change places with any man who has earned an extra dollar because he has made the work cost a little more.

Economic Laws Enter the Case

For argument's sake let us forget the human being and deal with the question scientifically, if I may so term it. We all admit the "law of supply and demand" fixes the price of everything. A cost-plus contract is obligated to no such law. The "survival of the fittest" is another law that the years have not been able to change one iota. This law must also be ignored in cost plus work because the standard of success has been removed.

After all is said and done, a contractor has certain merchandise to sell. If he does not know its value, he certainly ought not to be able to sell it.

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*Engineer and Contractor, Chicago, Illinois, in Bulletin of the Associated General Contractors.

Granite and Marble Dealers Meet

The annual convention of the Granite and Marble Dealers of the Province of Quebec was held at the Queen's Hotel, Montreal, February 16-17. In the abscence of Mr. H. Morris, the president, Mr. Joseph Murphy, first vice-president, occupied the chair. The sessions on the 16th were mainly occupied with the consideration of cost of material and labor, Mr. A. Brault, of Valleyfield, delivering an address on this subject. The first day of the convention closed with a banquet. New business and the election of officers occupied the last day. The election of officers resulted as follows: President, Mr. J. Murphy, Montreal; first vice-president, Mr. A. L. Smith, Montreal; second vice-president, Mr. I. Barron, St. Hyacinthe; secretary-treasurer, Mr. Arthur Brault, Valleyfield.

In the Contracts Department of the January 21 issue of the Contract Record, it was announced that the city of St. Thomas, Ont., had awarded the contract for electrical pumping equipment, at $23,000, to Goldie & McCulloch Company, of Galt, and the contract for an auxiliary gasoline engine system, at $4,000, to Arthur S. Leitch Company, Kent Building, Toronto. This information was in error and the facts as correctly stated are: Contract for electrical pumping equipment awarded to Arthur S. Leitch Company, at $27,250, and the contract for auxiliary gasoline engine system to Goldie & McCulloch Co., at $23,000. In supplying this equipment, Arthur S. Leitch Co. are representing the Dayton Dowd Co., of Quincy, Ill.

Manchester's Experience with Activated Sludge

Year's Operation of English Installation Shows that No Difficulty in Operation Need be Expected

IN the annual report of the Manchester (Eng.) River Department, extended reference is made to an activated sludge sewage purification plant in that city, known as the Withington works. Excerpts from this report are given herewith:

During the year a total volume of 59,228,000 gallons of sewage, which had been screened and passed through detritus tanks whose capacity is equal to approximately forty minutes' dry-weather flow, was treated in this plant, an average of 172,000 gallons per day (actually in operation). The plant was out of commission for a period of twenty days in consequence of the closing down of the power plant.

The operation of the plant has been handicapped by an uncertain air supply consequent on difficulties experienced, especially during the summer months, in maintaining an adepuate steam supply. The actual volume of sewage purified by this plant has, of course, been influenced materially by this factor and also by reason of its use as a demonstration plant for the purpose of obtaining additional information with respect to the factors controlling its economic operation.

The following typical average analytical returns will give a general idea of the results obtained:—

Average Results in Grains per Gallon

Dry Weather Sewage—Low Air Supply

Flow roughly proportioned to rate the sewage is received	Screened and detritus-freed sewage	Effluent
Four hours' oxygen absorption	2.73	.51
Free and saline ammonia	1.86	1.62
Albuminoid ammonia	.46	.08
Nitrite and nitrate (in terms of NH_3)	—	.10
Dissolved oxygen absorption (*Royal Commission Test)	—	.65
Volume of sewage treated	250,000 gals. per day.	
Air consumption	1.0 cubic foot free air per gallon of sewage treated	

Dry Weather Sewage—Maximum Air Supply

Uniform rate of flow	Screened and detritus-freed sewage	Effluent
Four hours' oxygen absorption	2.47	.46
Free and saline ammonia	2.10	1.08
Albuminoid ammonia	.415	.07
Nitrite and nitrate (in terms of NH_3)	—	.45
Dissolved oxygen absorption (*Royal Commission Test)	—	.65
Suspended solids	12.6	2.1
Volume of sewage treated	250,000 gals. per day.	
Air consumption	1.7 cubic feet air per gal. of sewage treated	

Wet Weather Sewage—Low Air Supply

Uniform rate of flow	Screened and detritus-freed sewage	Effluent
Four hours' oxygen absorption	1.77	.47
Free and saline ammonia	1.36	1.14
Albuminoid ammonia	.325	.09
Nitrite and nitrate (in terms of NH_3)	—	.26
Dissolver Oxygen Absorption (*Royal Commission Test)		.70
Suspended solids	9.1	2.4
Volume of sewage treated (average)	334,000 gals per day.	
Air consumption	0.80 cubic foot free air per gal. of sewage treated.	

*Standard recommended = 1.40.

There Need be no Difficulty in Operation

The experience gained with this installation during the year under observation may be summarized as follows:—

(1) The satisfactory results previously published obtained by the treatment of the Withington sewage by the activated sludge process have been well maintained.

(2) The idea that the scientific control required for the successful operation of the process would render its adoption impracticable has been proved to be without foundation. Provided care is taken to establish the factors controlling success—i.e., the period of aeration and volume of air required for the production of a satisfactory effluent from any given sewage—no difficulty need arise in the operation of an activated sludge plant if proper attention is paid to the efficient settlement of the sludge and to its regular return to the aeration chamber, so as to maintain the requisite volume of sludge in contact with the sewage.

(3) This volume may vary considerably—e.g., from 15 per cent. to 30 per cent—by volume measured after one hour's settlement, without interfering materially with the purification effect. Uuless a high degree of nitrification is desired, the operation of the plant is facilitated by employing a sludge content approaching the lower of these two limits. In this way there is less liability of difficulty with sludge settlement, and, of course, the volume of sludge in circulation—i.e., to be raised by air lift—is reduced, while it is quite sufficient to produce a perfectly clarified and thoroughly stable effluent.

Diffusers Give Excellent Service

(4) One of the outstanding features of the experience with this plant is the highly satisfactory operation of the diffusers employed. It has not been necessary to replace any of these diffusers, although at the time of writing they have been in actual operation for a period of two years. Only six of the 300 employed have been removed from the tank, and replaced after cleaning, to remedy indifferent diffusion. It is also important to note that, so far, no signs of clogging have been observed. Careful observation of the air pressure employed give no indications of any rise due to increased friction. The air pressure only varies from 3.1 lb. to 3.25 lb., dependent on the volume of air passed through the diffusers. In this connection it will be remembered that the depth of water in the aeration tank is 6 ft., measured from diffuser to water level.

(5) The earlier determinations of the column of air required have been confirmed. Unless a high degree of nitrification is required, an air consumption of 1.0 cubic feet of free air compressed to 3.1 lb. per gallon of sewage treated is sufficient to produce a satisfactory effluent under average conditions. In periods of dry weather this volume should be increased to a minimum of 1.25 cubic ft., mainly to avoid disturbance with the settlement of the sludge. It would appear that the additional air supply is concerned with the maintenance of a thoroughly active state of the sludge, and it

is possible that re-aeration of the sludge prior to its return to the aeration chamber might be advantageous, even with a weak sewage of the character of that treated at the Withington works. In wet weather, when the sewage is diluted by rain, satisfactory effluents may be obtained with an air consumption as low as 0.8 cubic ft. free air (compressed to 3.1 lb.) per gallon of sewage treated.

Effect of Rate of Flow

(6) In view of the criticism directed against the employment of a more or less uniform rate of flow throughout the twenty-four hours, comparative trials have been made with the rate of flow, roughly proportional to the rate it is received at the works—i.e., with the day flow approximately double the night flow. The results obtained show that the purification is well maintained, although the composition of the final effluent varies slightly on account of the fact that the average strength of the sewage thus treated is increased.

(7) Further determination of the sludge production agree fairly closely with the figure already published of 0.5 ton dry matter per 1,000,000 gallons of sewage treated. The actual volume of sludge this solid matter represents depends on the means adopted for the removal of the surplus sludge from the installation. The water content of the sludge removed need not exceed 98.8 per cent., which means an actual sludge production of approximately 42 tons per 1,000,000 gallons sewage treated. As previously reported, the volume of this sludge can be considerably reduced by ordinary settlement.

Dewatering of Sludge

The problem of dewatering the resultant sludge so that full advantage may be taken of its value as a fertilizer has received attention, but the progress made in this direction is not such as could be desired.

Fairly extensive trials have been made with an experimental continuously-operated centrifuge. The sludge has been treated by this machine, both with and without preliminary treatment, such treatment having included (1) settlement; (2) acidification; (3) application of heat.

The results so far obtained are not very encouraging, the best trial under most favorable circumstances yielding a product containing 85 per cent. water. While this means a very great reduction in the volume of the sludge treated, the water content is still too high to consider direct heat as a means of reducing the material to a marketable product. A considered report of this research is reserved for a later communication when other preliminary methods of treatment have been studied, including the application of electrical energy. It is also proposed to compare the effect produced by treatment under various conditions, in a special experimental press, with that of centrifugal action.

Fill and Draw Activated Sludge Plant

The "fill and draw" activated sludge plant at Davyhulme, a general description of which appeared in the appendix to the annual report for the year ending March, 1917, has been in operation throughout the year. Generally speaking, this tank, whose capacity is 20,000 gallons, has received three fillings per day, with an average aeration period of five hours, and has thus dealt with 45,000 gallons of screened sewage per day.

The following average analytical returns show that a satisfactory effluent has been obtained:—

Results in Grains per Gallon

	Screened sewage	Effluent
Four hours' oxygen absorption	6.64	.93
Percentage purification	—	86%
Free and saline ammonia	1.94	.93
Albuminoid ammonia	.54	.09
Percentage purification	—	85%
Nitrite and nitrate (in terms of NH_3)..	—	.44
Dissolved oxygen absorption...	—	.58

(*Royal Commission Test)

*Standard recommended = 1.40.

The arrangement of this experimental plant precludes any addition to the information already obtained with respect to the economics of the process. It has therefore been kept in operation mainly to note the results to be obtained, over long periods, in the treatment of the city sewage, containing as it does a great variety of trade wastes.

It is satisfactory to report that there has been no material interference, due to the presence in the sewage of inhibitory trade waste, during the year under observation. As previously reported, however, the trouble has been experienced occasionly by the admittance to the tank of an undue proportion of oily matter, which, although it has not interfered with the bacterial activity of the sludge, has, by emulsification, resulted in the production of turbid effluents. Such experience confirms the opinion, frequently expressed, that arrangements should be made whereby any appreciable amounts of oils, &c., are removed from the sewage prior to treatment in the aeration chamber. This has been borne in mind in the design of the large scale continuous-flow unit described below.

Large Scale Continuous-Flow Activated Sludge Plant

This plant, has been under construction during the year under observation. Its design is based on the experience gained with the operation of the plants at the Withington works and elsewhere, and also on the information obtained from a glass demonstration tank constructed by Messrs. Jones & Attwood, Limited, at their works, to study the currents produced by the admission of diffused air into water.

Briefly, the plant may be described as follows:—

Preliminary Grit Chambers.—These detritus chambers are provided owing to the inadequacy at times of heavy rainfall of the existing screening and detritus chamber at the entrance to the works. The dimensions of each of these two chambers are 12 ft. 8 in. by 15 ft. by 8 ft. 6 in. deep (approximate water level) and their combined capacity is 20,000 gallons. Two Clifford inlets are aranged in each tank, and the sewage is raised by air lifts (combined capacity 2,000,000 gallons per day) from these preliminary grit chambers to the aeration chamber. These chambers should also act as grease traps and arrest any undue proportion of oily matter in the sewage.

Aeration Chamber.—The aeration chamber, which is 241 ft. long and 9 ft. deep (water level to diffuser) is divided by two longitudinal walls so as to form a channel 8 ft. wide and 723 ft. in length. Its capacity is 322,425 gallons. The floor of the tank is level throughout. Aeration is effected through lines of diffusers placed alongside the curved footings of these divisional walls on one side of the channel only. The diffusers are 4 ft. by 7 in. (over all), so that their total tank area is approximately one-fourteenth of the aeration tank area. The ratio of actual diffusion area to total tank area is approximately 1.18. An overhead system of air pipes is provided, and the air admitted to the diffusers by a series of down-pipes, one to each diffuser. Valves are arranged on the air mains so that the tank may be sectionised so far as air supply is concerned. In addition, each down-pipe is fitted with a needle and orifice control for securing uniform air distribution. Cross-baffle walls, each with 3-ft. by 1-ft. openings over the diffuser lines, are constructed at intervals of 16 ft. along the whole length of the aeration channel.

Sludge Re-areation Channel.—This channel runs alongside the aeration chamber, and is consequently 121 ft. long. It is 4 ft. 6 in. wide, and its capacity is 52,650 gallons. The re-aeration of the sludge as it passes down this channel from the settlement tanks to meet the incoming sewage passing into the aeration chamber is effected through diffusers arranged similarly to those in the aeration tank. Cross-baffle walls are also provided. Surplus sludge will be removed from the end of this channel adjacent to the grit chamber through a pipe which passes to the existing sludge subway.

Settlement Tanks

Two types of settlement tanks are provided, which can be operated independently or together in parallel—

(a) Circular Tank.—The diameter of this tank is 29 ft. 2 in., and its mean depth to water level is 11 ft. 6 in., with a water holding capacity of 56,130 gallons. Four Clifford inlets arranged symmetrically are provided, and the effluent leaves over the periphery cill. A helical scraper operated through gear from a water wheel fixed in the discharge effluent channel is provided to move the deposited sludge to an opening in the centre of the floor of the tank, which communicates with a separate sludge pit. An air lift is fixed in this sump, by means of which the sludge is discharged into the sludge re-aeration channel.

(b) Inverted Pyramidal Tank, with four pockets. —This tank is 28 ft. 8 in. square; its depth from water level to the apex of the pyramids is 21 ft. 6 in. Its water-holding capacity is 69,370 gallons. Four Clifford inlets are arranged over the centre of each of the pyramidal pockets, and the effluent leaves the tank over a periphery cill. Earthenware pipes convey the deposited sludge to four separate sludge pits, each provided with air lift for discharging the sludge into the re-aeration channel.

One Million Gallons per Day

The effluent from the plant passes through a measurement chamber prior to its discharge to the culvert entering the canal. It is anticipated that this plant will be capable of treating 1,000,000 gallons of the city sewage per day, with the production of a satisfactory effluent. At this rate the sewage treated would receive approximately six hours' aeration, and the sludge prior to its return to the aeration chamber would be re-aerated for from two to four hours, dependent on the volume of sludge in circulation.

While the general lay-out of this plant is somewhat similar to that of the installation at the Withington works, it differs in many respects from the latter plant in actual design. Such alterations in design have been adopted with the idea mainly of reducing the cost of construction without lowering the efficiency of the plant. The chief new features are the flat-bottomed aeration chamber, which does away with the costly concrete ridges employed in the Withington plant, and a reduction to the extent of 50 per cent. of the diffusion area, with consequent considerable saving in the equipment charges. In addition, arrangements are provided for the re-aeration of the sludge in circulation, which it is considered will be advantageous in the case of the treatment of a strong trade sewage. The success or otherwise will depend very largely on the volume of air required to produce a floor velocity sufficient to obviate the deposition of the sludge.

At the time of signing this report the construction and equipment of this plant is practically complete, but unfortunately it cannot be brought into actual operation until an auxiliary power supply is available. This matter has been subject to unavoidable delay, but a scheme is now in hand whereby electrical power will be obtained from the nearest public supply. The air necessary for the operation of the plant will be obtained from three electrically-driven Reavell air compressors, the capacity of each of which is 500 cubic ft. per minute.

The estimated cost of this installation was $65,000, made up as follows: $45,000, constructional work; $15,500, equipment supplied by Messrs. Jones & Attwood, Limited; $4,500, erection and housing of air plant, measurement of air flow, etc.

The total expenditure during the period covered by this report was $26,795.

Code of Practice for the Contractor

A Statement Submitted to the Committee on Ethics of Associated General Contractors

In all dealings with fellow contractors, with subcontractors and supply houses, with owners and their representatives, with labor, and with the public, the general contractor should ever be guided by the principles of fair practice that are generally accepted as just in the business world. In addition, the reputable contractor will observe and be bound by all rules of practice established for the good of contractors and generally recognized as beneficial, and will lend his willing support to their enforcement, so long as the interests of the public are not thereby endangered.

Skill, Honesty and Responsibility

Those qualities of honesty, skill and responsibility required for membership in the Associated General Contractors of America should become the guiding factors in determining the general contractor's relations with others. Honesty of purpose should be the basis of all his business transactions. This presupposes a reasonable degree of skill in performing whatever work he may undertake, and the possession of sufficient resources, including organization, equipment and finances, to enable him to carry the work to a successful conclusion, and he should be willing to prove the existence of these resources upon demand.

No reputable contractor will enter into a contract for the execution of any project for which his training and experience have not fitted him, nor will he embark upon an enterprise for the execution of which his resources, including assistance that he can reasonably expect, are not sufficient to carry out the undertaking. This is not to be interpreted that personal experience in any particular field of construction is a pre-requisite to entrance into that field, but the contractor or his representatives should have demonstrated their ability to handle construction work on a scale similar to that proposed, and preferably work of a similar nature.

Bidding

No contractor should be a party to any method of letting a public contract not in accordance with the recognized legal procedure and established fair practice.

On private work, a fair code of bidding practice should be adhered to strictly for the joint protection of the contractor and the owner or his representatives.

When a contractor is invited to submit a proposal on work for which he is unable or unwilling to compete, he should immediately notify the architect or engineer to that effect.

No general contractor should submit a borrowed or accommodation bid.

Where plans for securing payment for estimating are in force, no contractor should collect payment for an estimate without the knowledge of the owner or his representative.

After bids have been opened and rejected, no contractor should be a party to the award of the contract until new proposals have been taken in due form.

Recognition of Existing Agreements

In undertaking work in a locality where there are generally recognized agreements in force between contractors and labor, between contractors and architects and engineers, or between contractors and any other group, a contractor should respect these agreements, if possible; or he should confer with those responsible for such agreements regarding them; or he should publicly announce his intentions not to abide by the terms of such agreements, giving his reasons for so doing. Changes in an agreement should be brought about, as far as possible, through joint consent of accredited representatives and not through infraction of its provisions. Much of the stability and prosperity of the construction industry is entirely dependent upon the strict adherence to agreements and codes of practice not always enforceable by law.

Loyalty to Contractors as a Group

Upon each general contractor falls the responsibility of maintaining and building up the reputation of contractors as a group. His duty to his fellows and to himself demands that by energetic application and keen attention to the enterprise in hand, he keep the standards of contracting high and add to its good reputation. Where not opposed to public interest, he should work loyally for the success of measures brought forward to benefit contractors as a whole, regardless of his present interest or lack of interest in the plan.

Work for the Public Welfare

Since it is part of every man's duty to participate in movements to protect and advance the public welfare, the general contractor should exert his influence toward furthering the interests of the public. Particularly in matters in which his experience makes him unusually well qualified to act, he should give freely of his thought and support, and hold himself in readiness to assume responsibilities should that be requested of him. He should co-operate with public officials in the discharge of their duties in matters where such co-operation is proper, and should watch carefully to see that none of the laws pertaining to construction are violated on his operations.

By sincerely following these general principles as a basis, with the further guidance of a series of decisions from the Committee on Ethics concerning representative cases, members of this Association will continually offer proof of their integrity and responsibility, and will safeguard the good name of contracting.

Owner-Contractor Co-operation Cuts Costs of Construction

THE high cost of construction which is so powerfully influencing not only those industries directly involved, but also the living conditions of the whole population, has caused a wider and deeper attention by those concerned to the fundamentals of the construction industry. Perhaps out of this forced consideration will develop new methods of business and technical practice which will in the future raise the efficiency of the industry and stabilize costs and relations. Certainly all parties in actual construction should study the whole field so that they may effectively direct their efforts to improving their own side of the problems. This idea is developed in an article by Richard Deming, vice-president American Surety Co., in the New York Evening Post and reprinted by "Concrete." This article is abstracted as follows:

The owner of a building or prospective building has been inclined either to postpone his activities or to go ahead, blaming the material manufacturer, the construction worker, the contractor, and conditions generally. As is natural, he expects improvement from the others, not realizing that it is within his power to help better conditions—and that it is perhaps his duty, at least to the industry to do so. And incidentally, it will be to his own advantage, for improved construction conditions will inevitably accrue to his benefit. Almost as important as materials, labor and management, is the factor of relations between owner and contractor—and there is considerable opportunity for constructive effort by the owner.

The More the Risks the Greater the Cost

In general, in the actual construction of a building or any other project, the contractor takes the risks. The more risks the contractor is asked to take, and the less certain the probability of profit, the higher will be the cost of construction and the greater will be the chances of failure. It is therefore up to the owner to reduce the hazards of the industry as far as is in his power—not only as an individual on his own particular work, but as a member of any organizations of owners to which he may belong. Stabilizing the business of the contractor will help stabilize the whole industry—and the business of the owner.

The business of the contractor is probably more hazardous than that of any other producing industry. There are more doubtful elements in a construction job than in any bill of goods. It requires either more "nerve" to take chances or more "gall" to cover chances. More foresight; more skill and accuracy in figuring; better management in controlling every new combination of conditions—these distinguish the task of the contractor. When a manufacturer sees that costs are running ahead of estimates, all he need do is to send out a little "announcement to the trade," which "passes the buck" to the consumer. When a contractor finds himself on a losing job, under the usual form of contract, he can overdraw his bank account, mortgage his house or equipment or call a meeting of the creditors. The owner may be protected by a good surety bond—there is no protection for the contractor against loss. The best—or worst—he can do is to "pass the buck" to the surety.

While the greatest opportunity of the owner in bettering construction conditions is in his relations with the contractor, there are many other points at which he may help reduce the hazards under which the contractor works and thus increase his own chances of getting satisfactory service at the minimum price. The contract is the expression of the business relations between the owner and the contractor. But it can be more than a legal document binding the contractor to his task—it may be made an instrument of mutual co-operation for effective and economical results, for helpfulness and for the reduction of unnecessary hazards.

This does not mean that the owner should take upon himself the burden of all risks—or even share them with the contractor. It does mean that a contract may take into account the difficulties which confront the contractor and make allowances for them and help him obviate them if this does not involve any unreasonable effort on the part of the owner. A contract does not have to be what it so often is—handcuffs and chains which the owner puts on the contractor, defying him to do his best.

The Cost-Plus Contract Will Help

Without going into the relative merits of the various types of contracts, the need for more equitable contract methods should be emphasized. All factors in the industry are beginning to realize this—as indicated by the growing use of "cost-plus" forms of contracts. Under the stress of war conditions, the weaknesses of the "lump sum" contracts were exposed. The contractor was not sufficiently protected—he had to work within fixed limits, fixed before conditions rapidly changed. Rising prices of materials; shortage of labor, higher wage scales and industrial unrest; restricted transportation facilities—the combination of all these adverse conditions of the war and readjustment period resulted in severe losses to most contractors and failure for many. Some owners, such as State highway departments, have given a measure of relief through special legislation authorizing additional payments—but private owners have not shown any general disposition to share burdens.

The exigencies of the war popularized the "cost-plus" type of contract, but there is no doubt that a reaction has set in against too extreme and loosely liberal forms of the indeterminate contracts. The owner is not afforded adequate protection against deliberate extravagance or careless indifference on the part of the contractor or his workmen. Somewhere between the two extreme types is the most equitable, and we are now in a period of wholesome experiment with various forms in search of the best. There is room for much sincere work and intelligent co-operation in the development and formulation of better contracts and the business principles on which they are based.

The Time Element

In the specific clauses of the contract there are many possibilities of strengthening the contractor without weakening the protection of the owner. In all cases reasonable consideration should rule. In the fixed time limit required in most contracts there should not be an attempt to rush the contractor, unless speed is an essential factor. It is to a contractor's own advantage to make good time, and unnecessary haste may result in bad work. Even when nature is assisted, concrete takes time to set. Provision for a penalty is desirable, but this should be preferably small—certainly it should never be excessive as compared with possible damage. Extensions should be provided for and allowed whenever the architect or engineer considers them reasonable because of unforeseen delays. At the same time, many contracts would be much fairer if they provided for a penalty to be paid by the owner for unwarranted delays caused by him or his agents. There are at this very time a number of cases in the courts which would have been obviated if the contractor had had recourse to a definite contract clause rather than the law.

Most Contracts Do Not Provide Proper Payment Clauses

In the matter of payments the average contract is very one-sided. They are merely provided for—there is no enforceable clause requiring definite dates and warning of penalties. It is unreasonable to ask a contractor to tie up all available capital in materials and equipment and to continue to pay out current expenses of labor and supervision without receiving regular payments even on parts of work already done. A reasonable clause binds the owner to pay from 80 per cent. to 90 per cent. of value of work done as estimated by the owner's technical representative, and the balance soon after completion.

The Quantity Survey—Divide the Cost

The physical conditions which are to confront a contractor should be clearly and accurately defined. It may be legitimate to expect a contractor to come and look over the ground for a nearby job or one of unusual size, but he should not be expected to make extensive or intensive investigations. Where there are possibilities of very adverse conditions the greatest care should be taken by owner and engineer to discover and describe them. The courts are still deciding and contractors still recovering from difficulties arising from the engineers stating a few years ago that an underwater tunnel was to be bored through rock and the contractors found quicksand. In such doubtful cases provision should be made for proper adjustment where the contractor finds either deliberate or unintentional misrepresentation. The most trouble comes from projects involving subaqueous or underground work—sewers, water mains, tunnels, deep excavation, foundations, dredging, etc.—in these types of work the owner and engineer should appreciate their responsibility.

Where the project is of an unusual nature or considerable size it is not desirable to make bidding a guessing contest. The fairest plans and specifications include an accurate "quantity survey" which will eliminate all guesswork or difficult and expensive figuring, and put all bidders on an equal basis. The owner should provide this survey and either pay for it himself or have the cost divided among the bidders.

Hints for the Contractor

That May Save Him Time and Money—We Will Pay for All Accepted Items—Send One In

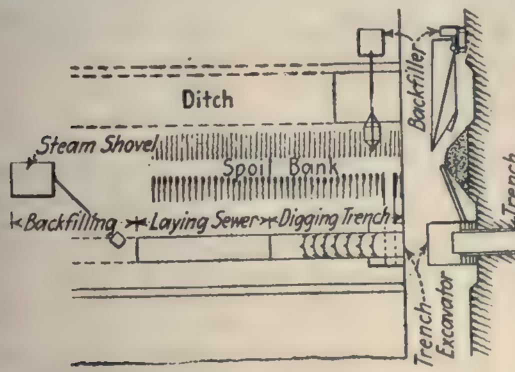
Solution of Lye and Lime Facilitates Removal of Paint from Steel Structures

By F. A. McLean*

A SIMPLE and effective way of removing old paint from iron and steel structures is to dissolve one pound of concentrated powdered lye in three quarts of hot water adding lime to make the solution thick enough to spread evenly. The solution should be applied as soon as it is mixed, by means of a brush and allowed to remain on the surfaces to be cleaned until it is almost dry. If it is then removed it will take the paint with it unless it is very old and thick, in which case a second coat of the solution should be applied after first coat has been washed off the surface. Before applying a new coat of paint, the metal should be thoroughly washed with a solution composed of one-half pound of sal soda dissolved in two gallons of warm water. After the soda solution has been applied, the surface of the metal should be wiped or warmed until thoroughly dried. A method similar to this is in use by the United States Coast Artillery for cleaning the exterior portions of big guns and their carriages.

Ditch Dug to Receive Surplus Excavation from Trench

FACILITY in disposing of surplus excavation from sewer trench is gained by a Detroit contractor in the manner indicated by the accompanying diagram from Engineering Record. A 4-ft. trench about 20 ft. deep. for a 4 x 6 ft. egg-shaped brick sewer is being dug by a trench excavator in an unpaved street in a sparcely built-up district. The material below the top soil is clay, which cannot be disposed of except by long haul to dumps, as property owners will not use it for grading or allow it to be scattered on their land. Since the volume of excavation displaced by the sewer had in some way to be wasted, the contractor excavated, with a steam shovel, a broad, shallow ditch. The excavation took only the top soil, which was loaded into wagons and which could be readily disposed of on nearby and often adjacent lots. The volume of the ditch was approximately the volume of sewer displacement. A power backfiller taking from the spoil bank filled the ditch. Then the remainder of the spoil required to refill the trench was filled back by steam shovel. With the machine outfit indicated, about 35 ft. per day of 4 x 6-ft. brick sewer was averaged.



Backfilling method on sewer job

Service Tests Indicate Possibility of Using Sodium Fluoride as a Wood Preservative

TESTS made years ago at the U. S. Forest Products Laboratory indicated that sodium fluoride might be successfully used as a wood preservative, because it has high toxicity, was not injurious to metal, and was convenient to handle. Laboratory tests alone, however, are never sufficient to establish the value of any material as a wood preservative; actual service tests, even though they require years to complete, are also needed.

In order to obtain comparative durability records, the laboratory in 1914 placed sap-pine ties treated with sodium fluoride, together with ties treated with zinc chloride and creosote, in one of the mines of the Tennessee Coal, Iron and Railway Company, at Birmingham, Alabama. Similar service tests were also started at this time on red oak ties placed in the tracks of the Baltimore and Ohio Railway Company.

After five years of service the mine ties which were treated with sodium fluoride have been found in as good condition as those treated with zinc chloride, both showing very little deterioration. The creosoted mine ties apparently were in still better condition, while the untreated ones were in various advanced stages of decay. The red oak railway ties treated with sodium fluoride were practically all sound, as were those treated with zinc chloride, whereas a large percentage of the untreated oak ties had been removed.

Both of these tests, as well as others started later, must continue for a number of years yet before the relative value of the sodium fluoride treatment for ties and timbers is definitely known.

Ditcher Working in Close Quarters Picks Us Rails in Single Track Tunnel

ON the Northern Pacific Ry. there is a single-tracked tunnel a mile long in which rail replacement has always been a very difficult job. Until not very long ago such work had always been done by hand, because the men in charge did not believe that it was possible for a machine to work in such restricted quarters. When old rail was to be taken up, the spikes were pulled and the rails shoved to one side, still connected together. In this shape they were dragged out of the tunnel by a locomotive. Outside they were disconnected and loaded onto cars by hand. The cost of replacing the old steel and loading

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*Publicity Department, Canadian Ingersoll-Rand Co., Limited, Sherbrooke, P.Q.

No. 7

Canada's Contractors—Roger Miller

Few contractors in Canada are identified with as many interests, or have such an extended experience as Mr. Roger Miller, president of Roger Miller & Sons, Ltd., engineers and contractors, Toronto; president of Roger Miller & Company, Ltd., contractors, Prince Edward Island and Shediac, N. B.; president Clayburn Co., Ltd., fire brick manufacturers, Vancouver, B. C. As a contractor, Mr. Miller has specialized on marine work, and it is in this field that most of his experience has been gained. He was born at Jerseyville, Ancaster Township, Ontario, in 1849, and was educated in the public schools of Ingersoll, Ont., and at Trinity Medical College, Toronto. Following his study of medicine at this institution from 1865 to 1869, he engaged in mechanics under his father, who was a carpenter and builder in Ingersoll. From 1872 to 1875 he gained some valuable experience in general storekeeping but in the latter year became foreman and overseer for the Government on the northern section of the Welland Canal. He held this position till 1879, when he became a member of the firm of Townsend, Miller & Company, which had the contract for the lock gates on the Welland Canal. From 1878 to 1905 he was a member of the firm of J. & R. Miller, contractors, builders and mill owners, owning sawmills at Markdale and Grand Valley, Ont., and grist mills at Elgin, Ont. The firm obtained government contracts for all lock gates from Sault Ste. Marie to the Soulanges canal. In 1908 his brother retired and the partnership of Roger Miller & Sons was formed, the company being incorporated in 1910, with Roger Miller as president.

The contracting companies of which Mr. Roger Miller is president, have carried out very extensive contracts, largely of a marine character. Some of the outstanding projects undertaken under Mr. Miller's direction have been: repairs to the Sault Ste. Marie canal when the break occurred in 1909; the construction of all the new gates for this canal; the construction of the new duplicate intake for the city of Toronto; the 84-inch conduit from the Toronto filtration plant to the tunnel under Toronto Bay; the installation of connections from the new duplicate intake to the filtration plant and from the filtration plant to the 84-inch conduit; the building of all the lock gates for approximately half the Trent Valley canal; the car ferry terminals at Prince Edward Island; a large portion of the work in the building of the British Forgings plant at Ashbridges Bay, Toronto; the installation of the foundations for the plant of Baldwin's Canadian Steel Corporation, also on Ashbridges Bay; the widening of the upper entrance to the Morrisburg canal, St. Lawrence River; the lock gates for the East River ship canal at New Glasgow, N.S., and the carrying out of $1,250,000 worth of work for the Dominion Government on Toronto harbor. Other large works with which Mr. Roger Miller has been connected include repairs to the banks of the Lachine canal; the construction of the Toronto waterworks tunnel; breakwater and landing piers at Depot Harbor; breakwater at Port Stanley, Ont., and numerous other projects of a national character.

Mr. Miller was also connected, in a consulting capacity, with the construction of the New York State barge canal, and has been a member of a number of consulting boards in connection with engineering problems.

Mr. Roger Miller

Mr. Miller was also at one time a member of the contracting firm of Haney & Miller, and for two years was managing director of the Montreal Locomotive Works, and had charge of the building and initial operation of this plant. The present firm of Roger Miller & Sons, Ltd., includes, besides Mr. Miller, as president, his two sons, Fred and Roy.

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it for shipment was about $1,000, which includes the expense of repairing the roadbed and replacing ties damaged when the old rail was dragged out of the tunnel.

It was decided to give a ditching machine a tryout at loading the rails in the tunnel, instead of the usual large labor gang. The work train arrangement was as follows: An empty flat car was coupled in front of the one on which the ditcher was mounted and, with four laborers to hook and unhook the rail tongs, work was commenced at the east end of the tunnel. As soon as the car was loaded the train ran out of the tunnel, and another empty coupled on in place of the one just loaded.

As the tunnel was a single-track affair, naturally there was very little clearance, but so carefully did the operator handle his machine, and so responsive was it to the levels that the boom did not touch the walls of the tunnel. The fact that rails could be picked up only from one side at a time on account of the tight quarters, slowed up the work a trifle, but, at that, the job was completed in eleven hours of actual work and it was estimated that the saving over the old way of doing the same work was not less than $500.

Quebec Director of Housing

Dr. Nadeau has been appointed Director of Housing for the Province of Quebec, in connection with the Quebec Housing Law recently passed. A provincial housing scheme has also been prepared. The appointment of Dr. Nadeau, as Director of Housing, is significant of the importance which the province attaches to the promotion of housing schemes in the form of Garden Suburbs. Quebec has introduced town planning provisions in its housing scheme and the intention is to pass a Town Planning Act at the present session of the legislature.

Building Permits Still Surpass Those of Year Ago

ACTIVITIES in the building trades as indicated by the value of building permits issued in 35 cities showed a decrease during December as compared with the preceding month, the total value of building permits falling from $6,936,438 in November, to $4,945,539 in December, a decrease of $1,990,899, or 28.7 per cent. Nova Scotia was the only province to record an increase in this comparison.

As compared with the corresponding month in 1918 there was an increase of 201.1 per cent., the value for December, 1918, being $1,642,362. In this comparison all the provinces recorded substantial increases.

Of the larger cities, Montreal, Toronto, Winnipeg, Edmonton and Vancouver recorded declines as compared with the preceding month. In comparison with December, 1918, these cities reported large increases.

Of the smaller centres, Halifax, Sydney, Moncton, Sherbrooke, Westmount, Kingston, London, St. Thomas, Moose Jaw, Saskatoon and Victoria all recorded substantial increases, both as compared with November, 1919, and with December, 1918.

Estimated Cost of Building Work as Indicated by Building Permits Issued in Thirty-five Cities

City	December, 1919	December, 1918	December, 1919, compared with December, 1918 Increase (*) Amount	Decrease (†) Per cent.
Nova Scotia	**$374,083**	**$98,756**	*** $275,327**	*** 278.80**
Halifax	341,240	74,390	* 266,850	* 358.72
Sydney	32,843	24,366	* 8,477	* 34.79
New Brunswick	**67,600**	**5,825**	*** 61,775**	*** 1,060.52**
Moncton	67,600	5,825	* 61,775	* 1,060.52
Quebec	**828,151**	**192,420**	*** 635,731**	*** 330.39**
Montreal-Maisonneauve	658,401	176,045	* 482,356	* 274.00
Quebec	91,150	5,575	* 85,575	* 1,534.98
Sherbrooke	15,600	....	* 15,600	
Three Rivers	15,800	5,600	* 10,200	* 182.14
Westmount	47,200	5,200	* 42,000	* 807.69
Ontario	**3,187,337**	**1,132,118**	*** 2,055,219**	*** 446.73**
Brantford	78,325	1,565	* 76,760	* 4,904.79
Fort William	850	54,365	† 53,515	† 98.44
Guelph	4,100	350	* 3,750	* 1,071.43
Hamilton	180,750	309,900	† 129,150	† 41.67
Kingston	143,885	8,548	* 135,337	* 1,583.26
Kitchener	17,380	400	* 16,980	* 4,245.00
London	431,200	27,980	* 403,220	* 1,441.10
Ottawa	118,575	58,163	* 60,412	* 103.87
Peterborough	3,243	3,175	* 68	* 2.14
Port Arthur	1,714	4,721	† 3,007	† 63.69
Stratford	1,455	35	* 1,420	* 4,057.14
St. Catharines	29,125	15,545	* 13,580	* 87.36
St. Thomas	64,050	85	* 63,965	*75,252.94
Toronto	2,039,625	610,451	* 1,429,174	* 234.12
Windsor	73,060	36,835	* 36,225	* 98.34
Manitoba	**156,610**	**10,150**	*** 146,460**	*** 1,442.96**
Brandon	7,160	300	* 6,860	* 2,286.67
Winnipeg	149,450	9,850	* 139,600	* 1,417.26
Saskatchewan	**90,855**	**62,160**	*** 28,695**	*** 48.16**
Moose Jaw	48,900	47,950	* 950	* 1.98
Regina	12,400	5,160	* 7,240	* 150.00
Saskatoon	29,555	9,050	* 20,505	* 226.57
Alberta	**53,600**	**37,100**	*** 16,500**	*** 44.47**
Calgary	34,000	27,300	* 6,700	* 24.54
Edmonton	19,600	9,800	* 9,800	* 100.00
British Columbia	**187,303**	**103,833**	*** 83,470**	*** 80.39**
New Westminster	9,500	11,440	† 1,940	† 16.96
Vancouver	118,453	81,653	* 36,800	* 45.07
Victoria	59,350	10,740	* 48,610	* 452.61
Total—35 Cities	**$4,945,539**	**$1,642,362**	***$3,303,177**	*** 201.12**

Mr. F. I. Spielman, of Spielman Agencies, Regd., Montreal, has been appointed vice president of the Canadian Association of British Manufacturers. The object of this association is to further the interests of British trade and to deal with such matters as tariffs, taxes, freight rates, time limits for tenders, etc.

Pannill Door Co. Reports Brisk Demand for Doors

The Pannill Door Company, 131 Front St. E., Toronto, report a brisk demand for their stock and look forward to a successful season in the sale of doors. This company, of which Captain Hunter Pannill is the head, do a wholesale and retail business, dealing exclusively in doors. They carry a stock of several thousand in all sizes, in plain and quarter cut white oak, red oak and birch, and solid white pine, featuring the "Korelock" and "Kilmax" line. This company was formed a few months ago by Captain Pannill, who, previous to enlistment, was associated with the Northern Alluminum Co., of Toronto. Captain Pannill went overseas with the 38th Battalion of Ottawa, arriving in France in the latter part of 1915. He was wounded at Vimy Ridge and was sent back to London where he spent some months in the hospital. Upon his recovery he joined the Royal Air Force and qualified as an observer. Captain Pannill had some thrilling experiences while in the Air Force and was wounded by an explosive shell from an anti-aircraft gun while flying eight thousand feet above the German lines in September, 1917. After being confined to the hospital for nearly a year he returned to Canada in August, 1918. Captain Pannill was awarded the Military Cross for gallantry on the field. Major E. I. Harrington, one of the best known sash and door men in Canada is indirectly associated with Captain Pannill in this new firm. The success of this firm during the six months they have been in business points to a big demand for their products during the coming building season.

Presentation to John V. Gray

A few weeks ago the chief employees of the Jno. V. Gray Construction Co., Toronto, held a little surprise party with their chief and presented him with a gold wrist watch suitably engraved. A circumstance of this character goes far to prove the cordial relations between employer and employee which exists in this firm. It indicates the presence of that esprit de corps which is such a valuable asset in any concern, and, in these days of unrest, all too rare.

Trade Incorporations

The Cox Construction Company, with head office at Winnipeg, capital $60,000.

Kilmer & Barber, Limited, with head office at Toronto, capital $300,000, to carry on the business of contractors and builders.

Toronto Cement Products, Limited, with head office at Toronto, capital $40,000, to carry on the manufacture of cement, brick tile, etc.

National Building Company, Limited, with head office at Toronto, capital $125,000, to carry on the business of builders and real estate agents.

The firm of Crane, Limited, of Montreal, the largest dealers in plumbing, heating and engineering supplies on the continent, have purchased a site in Regina, and will shortly locate a branch in that city.

A general increase affecting almost the entire staff of civic employees at Guelph, Ont., has been granted.

Mainly Constructional

East and West—From Coast to Coast

Fifty miles of new rails, costing $150,000, will be installed in the London division of the Canadian Pacific Railway this year.

The estimates of Property Commissioner Chisolm, of Toronto, for 1920, will involve an expenditure in the neighborhood of $900,000 to be spent on new civic buildings and improvements.

It is reported that the Canadian branch of the Gartley, Weston Company, of Detroit, will be located at London, Ont. The firm are manufacturers of metal plating and will employ 500 men in their new plant.

Cornwall, Ont., will adopt the Dominion Government's housing scheme this year. At a recent meeting of the town council, Messrs. P. E. Campbell and A. C. Robertson were appointed as a housing commission.

Out of 300 municipalities in the Province of Saskatchewan, 294 have accepted the offer made by the Department of Highways, providing for the payment of grants by the Provincial Government for the maintenance of main highways.

Ten acres of land have been purchased by the London Housing Commission, in East London, which will be the site of a model community to be developed this year. Several applications for houses have already been received by the commission.

Building figures in the border cities of Windsor, Walkerville, Ford and Sandwich, Ont., for the past year, totalled approximately five and a half million dollars. Windsor lead with $2,601,370; Walkerville was next with $2,008,000; Sandwich, $457,000 and Ford, $400,000.

It is reported the Building Exchange at London, Ont., are contemplating the organization of an Industrial Council so that strikes and disagreements can be settled promptly by arbitration and not seriously affect the extensive building operations looked for during the coming season.

The Esquimalt & Nanaimo Railway will spend in the neighborhood of $1,000,000 this year on general construction and improvements. Included in this amount will be $150,000 for new offices in Victoria and $100,000 as the company's contribution towards the cost of the new Johnson Street bridge.

At a recent meeting of the Chamber of Commerce, Niagara Falls, Ont., several of the members pledged themselves to take stock in a new company to be formed for the purpose of building houses in the city. The company which will be known as the Niagara Falls Homes, Limited, will apply for a charter and will be capitalized at $250,000.

Mr. R. E. Kelly, president of the Western Ontario Highway Association, will head a deputation of citizens from the Border cities between Niagara Falls and Windsor, to wait on the Provincial Government in the near future to ask that the construction of Provincial highways in this district be of a permanent nature, surfaced with either asphalt or brick.

City Solicitor T. G. Meredith, of London, Ont., has ruled that the Council is not governed by the result of a vote of the citizens taken recently, which was against the construction of a $140,000 bridge across the Thames. The Board of Works is greatly in favor of the bridge which they claim is urgently needed, and it is more than likely, under the above ruling, that construction will be gone ahead with.

A deputation composed of: Mayor Gray and Reeve Sing, of Meaford; Mayor Patterson, of Owen Sound; Mayor Holden, of Collingwood; and Reeve Brown, of Collingwood township, waited upon Hon. Mr. Drury and Col. Carmichael recently to urge the taking over of the road between Barrie, Owen Sound, Meaford and Collingwood as a provincial highway. Premier Drury promised the consideration of this question.

A joint public meeting was held recently at St. John, N. B., composed of representatives of the local branch of the Engineering Institute, Commercial Club, the Board of Trade and several prominent citizens, for the purpose of considering the subject of town planning. W. F. Burditt, chairman of the St. John Town Planning and City Expansion Committee, read a very interesting paper on the subject, which embodied several worth while suggestions for local improvements. Mr. H. L. Seymour also spoke on "Some of the General Principles of City Planning with Application to St. John."

A delegation of property owners of Notre Dame de Grace, a suburb of Montreal, waited on the Administrative Commission recently, for the purpose of having the present bylaw, which provides only for the erection of detached or semi-detached cottages in this district, amended. Property owners, it was stated, are ready to erect two-storey buildings to the number of about 50, which would be capable of accomodating 100 tenants, thereby relieving the present congested conditions which exist. Commissioner Ross, who met the delegation, looked favorably on the scheme and promised his co-operation in securing this amendment.

Personal

Mr. J. Smythe, C. E., has been appointed superintendent of works at Cornwall, Ont., succeeding Mr. C. A. Lount. who resigned recently.

Mayor Fetterly and Mr. J. A. Chisolm, of Cornwall, Ont., have been appointed members of the Isle Perrot Bridge Commission.

Mr. Beaumont Jarvis, architect, of Toronto, originator of the Roman Stone Company, has taken up residence in Belleville, Ont., in which city he may, it is said, organize a concrete industry.

Mr. W. T. Randall, son of Mr. W. H. Randall, managing director of the Neptune Meter Co. Ltd., Toronto, has taken a position as salesman with this company. Mr. Randall, Jr., went overseas with the 180th battalion, being transferred to the 4th battalion in France. He was returned to Canada suffering from shell shock and on recovery went to New York where he had special training in the manufacture of meters with the Neptune Meter Company, of that city.

Obituary

Mr. Leonard Foulds, Toronto, died recently of pneumonia. For eleven years he was an architect in Toronto and during the war joined the 220th battalion. Since his discharge from the army, he has been connected with the drafting department of the Canadian National Railways.

Mr. George Plunkett Magann, one of the oldest railway supply contractors in the Dominion, passed away at his home 19 Dowling Avenue, Toronto, recently, following an attack of pneumonia. Deceased, who was in his 71st year, was formerly in the lumber business, but he was best known in connection with railway contracting, having had large contracts for the Grand Trunk, the Canadian Pacific and the Canadian National Railways.

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Engineers, Contractors and Architects to Advise on Montreal Building Code

THE Public Works Department of the City of Montreal has invited the Builders' Exchange, Engineering Institute of Canada, and the Association of Architects of the Province of Quebec to each nominate a member of the Advisory Board constituted under the new code of building bylaws, which has now taken definite shape. The Board will be composed of an experienced builder, engineer, and architect, and the object is to obtain the benefit of their help and advice at the period of organization, as well as after the code has been put in force.

The function of the Board for the present will be to advise the Public Works Department in regard to whatever changes it may be thought advisable to make in the preliminary draft of the code, and also in regard to building restrictions in the various streets and wards of the city, etc. Later the Board may be called upon to advise on all matters relative to the interpretation of the code, and make recommendations to the city authorities. The Board will meet as often as requested by the Director of Public Works, and the members will be paid a fixed sum per meeting. It is requested that members of the Board shall have a wide experience in their professions, and shall take a keen interest in the business in the building trade of the city, and shall thoroughly know the wards of the city, etc. The Builders' Exchange have sent in their nominations.

Mechanical Device Cleans Railway Ballast Efficiently and Quickly

AN interesting device has recently been put on the market after exhaustive tests that have proved its efficient application to the work of cleaning railroad ballast between trucks. The machine does mechanically what hand labor has been required to do in the past. It consists of a bucket elevator, a shaking or vibrating wire mesh screen, a gasoline engine with driving mechanism, the whole being mounted on a wide steel frame. It moves forward on two endless chain treads, similar to the well known "caterpillar" principle. It is propelled by a ratchet mechanism, operated by the same engine that furnishes power to the digging elevator. It can also be moved by a hand lever.

As the machine is "inched" along, the shovels dig up the ballast to a depth of 14 inches below the top of the ties, depositing it in the hopper of the shaking screen. The dirt falls through the screen to a tray beneath from which it is shovelled out by hand while the cleaned stone rolls down the inclined screen and back into the ditch. The construction is such that trains can pass on either track while the machine is operating. Four automatic insulated clearance arms keep the machine a pre-determined distance from either track.

This machine will clean 900 to 950 cubic feet of ballast per day, with four men, making the output per man average 225 cubic feeet per day, in contrast with an average day's work of 80 to 100 cubic feet per man under the old system of forking by hand.

Development in Waterworks and Sewage Installations in Canada

IN 1887 there were 30 waterworks in Ontario, 28 in Quebec, 1 in Alberta, 2 in British Columbia, 7 in Nova Scotia and 5 in New Brunswick, making a total of 73. To-day there are about 340 waterworks in operation, supplying about 450,000,000 gallons per day. The capital cost is about $125,000,000, which is an index of the growth in our municipal activities. There are now about 76 waterworks in the Prairie provinces, all of which, except Calgary, have been built in the last 33 years. Water filters are mostly of recent construction, the drifting sand filter in Toronto being the latest development. Toronto granted a franchise to a company to install waterworks in 1842, but in 1872 acquired the same. In 1887 there was a lively controversy as to whether this city should obtain its supply of water from Lake Simcoe or Lake Ontario. One proposal was to construct a canal from Lake Simcoe to the Humber River to supply power and water. A similar scheme was suggested from Lake Erie to Hamilton.

The problem of how best to dispose of sewage has been one of the usual difficulties in many places. Canada possesses many large rivers and lakes which are most tempting outlets for disposal. Mr. Willis Chipman, in 1912, read an interesting paper at the annual meeting of the Canadian Public Health Association, giving the history of several sewage works and the following items are extracted. The first practical attempt on sewage purification in Ontario was on the flat bed irrigation system, at the London Asylum in 1888. The first municipal sewage works built in this country was at Kitchener, 1892, followed by Waterloo, 1896. Hamilton installed the first chemical precipitation plant with presses in 1896. Stratford and Kitchener were the first to have the septic tanks, and Vernon, B. C., in 1912, the first trickling filters. The activated sludge process was developed in Manchester in 1913, but, up to the present, no plant has been built here. The Massachusetts State Board of Health has been conducting experiments in sewage treatment since 1888 and the activated sludge process was founded upon investigations which had been made at its Lawrence station.

A Cement Gun Installation Cures Trouble in Coal Mine

QUITE a troublesome condition frequently met with in bituminous coal mines is what is known as "buckwheat slate" reef. This is rather more descriptive than scientific, but it conveys the idea accurately. Broken slate rapidly disintegrates by the action of the air currents and falls continuously in small particles.

To timber against this condition is costly and also ineffective. Aside from the danger, the cost and inconvenience of maintaining men to clean the tracks is obvious, and delays to transportation from dirty tracks is quite a factor. It is seldom that pieces fall large enough to cause direct accidents, but the blocking of the tracks from fallen slate may cause wrecks to locomotives and cars.

At the Cadogan mine of the Allegheny River Mining Company conditions were encountered in one seam, through large sections of the mine, which for some time almost completely baffled the mine officials.

A very complete account of how this trouble was taken care of was given by Mr. Fred T. Norman, Chief Engineer of the Allegheny River Mining Company, in Coal Age, recently, his narrative being here reproduced.

At the instance of the superintendent of the mine an investigation of the work of the cement gun at the Bruceton Experimental Mine was made, with the result that the company decided to give this cement apparatus a tryout. To this end the necessary equipment was purchased and prepared for operations. The outfit comprised the cement gun, water tank, motor driven air compressor and receiver, all mounted on rail trucks, with, also, mixing board and sand screen.

To operate this outfit, six men were employed, as follows: One nozzleman, one gun operator, two attendants to screen and mix sand and two men to prepare the top and sides of the entry. All loose material must be carefully trimmed off before cement is applied to insure a good job. As high as 120 lin. feet of entry have been cemented in one eight-hour shift, but the average run falls short of this, and actually is, by computation of several months' work, 85 lineal feet per shift.

The gunite (or cement and sand mixture) consists of one part cement and three parts sand; it is blown against the rock face which is to receive treatment with about 30 lbs. per square inch pressure. The cement penetrates the small crevices and interstices to a considerable depth and the surface coating of gunite over the rock will average about five-eighths inch thick.

Great care must be exercised to remove all loose and disintegrated material, so that the gunite can get a good grip on solid rock.

The cement gun outfit at this mine was put into operation Sept. 12, 1918, and worked mostly during night shifts for sixty-four eight-hour shifts, up to the time statistics were computed. During this period 5,482 lineal feet of entry, or approximately 87,700 square feet of surface, was coated.

The average work per eight-hour shift was 85 lineal feet of entry, or 1,370 square feet of surface, covered with a five-eighth-inch thick cement coating. An accurate account of the cost of this work was kept, as follows:

Labor	$2176.03
Sand, 264 tons, at $2.65	699.60
Cement, 502 barrels, at $2.52	1265.04
Total	$4140.67
Cost per lineal foot of entry	0.7553
Cost per square foot of surface	.0472

The labor costs include: Loading sand, cement and water outside; trimming of entry; mixing sand and cement by hand; the operation of the cement gun; also the training of men for the work.

Up to the present time the cement coating of the entries has proved quite satisfactory and neither breaking of the coating nor signs of slacking behind the coating have been observed in work about eight months old. Thin places will show up in time and must be re-coated.

For brattice work the outfit also proves efficient; breakthroughs walled up with rock or slate are given a coating of cement and sand—gunite—which, by the force of the gun, penetrates every little crevice and effects an air-tight and quite satisfactory job.

The Cement Gun equipment can be utilized for many other purposes about the mine. When not in the cement gun service, the compressor is kept busy blowing out motors and generators, operating pick mining machines for entry driving, or furnishing power for air drills or rivet hammers if such work is demanded on a construction job, or special work of any kind.

To determine the benefit to strength due to mixing of cement and water for a long period (15 to 30 minutes), and then adding aggregate to produce a concrete instead of the ordinary method of mixing cement, aggregate, and water together for one to two minutes, comparative tests of concrete by the two methods were made last year by the U. S. Bureau of Standards. Exactly the same materials and amount of water were used. The compressive strengths obtained were about the same, indicating that there is no advantage in long premixing of cement and water from the standpoint of strength.

No. 13

Canada's Engineers—A. H. Harkness

Andrew H. Harkness, consulting structural engineer, Toronto, was born in 1873 in Dundas County, Ontario. He obtained his technical education at the School of Practical Science, Toronto, now the Faculty of Applied Science, University of Toronto, from which he graduated with honors in 1895, obtaining the degree of B.A.Sc. in 1897. For four years from 1898 he was on the staff of the School of Practical Science, as a fellow in civil engineering. His vacations and spare time were spent mostly in architects' offices and partly on municipal drainage work. From 1902 to 1909 Mr. Harkness was in the bridge department of the Canada Foundry Company, Toronto, serving, in turn, in the capacities of draftsman, checker, designer and assistant structural engineer on bridge and building designs. In the summer of 1909 he was engaged on the St. Andrews movable dam near Winnipeg, as engineer of erection and in the following year he went into private practice in Toronto, entering into partnership with Mr. J. M. Oxley in 1911, as consulting architectural and structural engineers. Mr. Oxley went overseas in 1915, but the same firm name was retained until April, 1919. At the present time Mr. Harkness is a member of the newly formed partnership of Harkness, Loudon & Hertzberg. Mr. Harkness has been retained as consulting engineer to the architect on a great number of buildings in Toronto and elsewhere, among these being: The C. P. R., Dominion Bank, Williams Piano Co., Excelsior Life and the Methodist Book Room buildings, Toronto; the Bank of Commerce and Confederation Life Building, Winnipeg, and the new Parliament Buildings, Ottawa. The industrial plants on which he has been consulting engineer for the design include: Boiler and machine shops for the John Inglis Co., Toronto; shops of the Hamilton Gear & Machine Co., Toronto; the Woods Mfg. Co., Toronto; Herbert Morris Crane & Hoist Co., Niagara Falls, and garage for the Automobile & Supply Co., Toronto. Mr. Harkness is a member of the Engineering Institute of Canada, and also a member of the American Society of Civil Engineers. During 1919 he was chairman of the Toronto Branch of the Engineering Institute of Canada.

Mr. A. H. Harkness

How to Build Fireproof Partitions

As a rule the partitions in fire-proof buildings are not required to support any weight, but merely to serve the purpose of dividing the space into rooms, and to confine a fire to the compartment in which it originates. No greater strength is therefore required in a partition than is necessary to carry its own weight. However, rigidity is required, and that in proportion to its height and unsupported length. Where partitions separate apartments or sections of a story, that is, when they practically are without window or door openings, they should be rigid enough to prevent the passage of water from a hose stream as well as flame. In other cases this may be unnecessary; in fact, at times it may seem desirable that the partitions are easily removed for the purpose of getting at a fire spreading through doors or windows.

The materials of partitions should be incombustible. They should also be poor conductors of heat. It is also desirable that they shall not be affected by water. Lightness is also a desirable quality, as any increase in the dead weight of the construction adds to the cost of the structure. Partitions should also be as sound-proof as possible.

So far as may be, fire-proof partitions should have no window openings in them, and even as few door openings as possible. In many buildings, however, where halls have no openings into streets or courts, such windows are necessary for lighting the halls. When this is the case the frames should be made fireproof and wire glass should be used, the sash being stationary, if possible.

B. C. General Contractors Appoint Officers

The General Contractors' and Master Builders' Association of British Columbia, at their annual meeting, held on Feb. 12, elected the following officers: Mr. T. F. King, president; J. C. Gill and J. Tucker, vice-presidents; George Murray, honorary treasurer; James Hart, secretary. The Executive Committee consists of Messrs. E. G. Baynes, W. J. Prout, H. A. Wiles, S. J. Newitt and E. C. Chrystal. Wage increases are requested by a number of trades. The bricklayers are asking the association for $9 a day instead of $8; painters are requesting $1 an hour and a 5-day week, and carpenters are also seeking general increases.

The Barber Asphalt Paving Company, Philadelphia, has issued a little folder descriptive of the new Iroquois Macadam Roller, which is claimed to embody a distinctive advance in design. The outstanding features of its construction are delineated in this folder. This company has also issued a sheet tabulating the kinds and amount of asphalt in Buffalo, N.Y., for each year from 1879 to the present.

The Quebec Government will assist in building a main highway from Richmond to Sorel.

The city council of Windsor, Ont., has joined hands with Ford City and Walkerville in a request that will be forwarded to the Ontario Legislature for the appointment of a harbor commission to control the waterfront on the Canadian side of the Detroit river.

Administration of Water Powers of Quebec and Activities of Streams Commission

Water Power Policy of Quebec Province Affords Safety for Capital Invested and Assures Public of a Share in the Value of These Resources—Storage Works Regulate Stream Flow

By Olivier Lefebvre, A.M.E.I.C.*

THE administration of the water powers of the province of Quebec is under the Department of Lands and Forests, more particularly through its Hydraulic Service Branch, of which Arthur Amos is the chief engineer.

The policy which prevails is the following:—

1. Water powers are leased for a period of 25 to 99 years, according to the importance of the power and the capital required for development.

2. The payment for the land granted of a fixed annual rental covering the term of the lease.

3. A supplementary annual rental which may vary from ten to thirty-five cents per horse-power developed, according to the facilities or difficulties of development. This supplementary rental may be revised every twenty-one years.

4. A delay of two years to start development, and two more years to begin the production of power.

5. A deposit guarantee.

6. The lessee must submit plans of the proposed works and report to the Department of Lands and Forests as to the amount of power developed in the plant.

In the case of rivers which are navigable and floatable, the lessee must submit his plans to the Federal Government, which has to protect the interests of navigation.

All water powers which, at mean low water have a capacity of 200 h.p. and over, have been declared of public interest, and the owner of such water powers may proceed to the expropriation of adjacent lands required for the proper development of its property, but this expropriation cannot be exercised against an industry previously established, or waterworks supplying the whole or part of a municipality. (Articles 7287, 7288, 7289, Revised Statutes of Quebec, 1909).

A law was passed in 1918, chapter 68, amending article 7295a of the Revised Statutes of Quebec, which stipulates that the plans and specifications for works proposed in streams of the province must be submitted to the Lieutenant-Governor in Council for approval. Before 1918, it was not possible to build dams for storage purposes unless authorized to this effect by a bill of the Legislature, but in 1918 a law was passed, article 7305a, by which such works may now be carried out, provided the plans and specifications have been submitted to the Lieutenant-Governor in Council and approved.

Such is to-day the water power policy of the Province, and it is claimed that it affords safety for capital invested. It assures the public of a share in the value of these natural resources, and it prevents any speculation in that development being imposed within a definite period under penalty of the lease being cancelled and the deposit confiscated.

Water Powers Unlike Other Resources

The writer believes that water power development should be encouraged as much as possible. Among our natural resources, it stands in a class by itself. In his work, "Conservation of Water by Storage," George Filmore Swain divides natural resources into three classes, as follows:

1. Those resources which are not renewable, and in which utilization, even though without any waste, necessarily destroys the store available for future generations. Such are coal, oil, gas, phosphates, and other mineral deposits. Every particle of these resources which is utilized diminishes by so much what is left for our successors.
2. Those resources which are self-renewing, though at a comparatively slow rate, requiring considerable time for a complete renewal. In this class are included the forests, which may be entirely cut down, but which will ordinarily reproduce themselves in time.
3. Water power falls in a different class from either of the above, and seems to occupy a place by itself, having several peculiar characteristics. In the first place, while resources of the first two kinds, if not utilized, are in general store and preserved for the use of future generations, water power if not utilized is constantly wasting, with no good results to anybody.

While, as stated before, the conditions under which water powers may be acquired from the Crown are only one of the factors which make their development desirable or not, this factor may help that development or it may retard it to a large extent.

Capital will not invest where the conditions are drastic or arbitrary, and it is not assured of proper protection by definite conditions covering a long number of years. It is claimed that the policy followed by the Province offers capital every guarantee of safety.

The amount of power there is available in Quebec has been estimated by Mr. Amos, Chief of the Hydraulic Service, as being five million horse-power, not including any territory above the fiftieth degree of latitude. As to the amount of power in the latter territory, no accurate estimate has been made.

Amount of Power Developed

A census of water powers developed in the Province of Quebec in 1918 was made by the Hydraulic Service. It was found that the amount of power installed was 832,274 horse-power. And this total does not include any station generating less than 1,000 h.p. It is estimated that, should the smaller developments be included, the amount of hydro-power installed in the Province must be 875,000 horse-power. Statistics prepared by the Dominion Bureau of Statistics, in collaboration with the Dominion Water Power Branch and the Hydraulic Service of Quebec, published recently, state that on the first of January. 1918, the primary power generated by water in this province was 575,551 horse-power, or 257 horse-power per thousand of population. The statistics compiled by the Province mention the capacity installed, while the Dominion Statistics mention primary power. The capital invested in the central electric stations in Quebec was at that tme $130,000,000. The total revenue from the sale of power at these stations was $14,350,000, and new installations contemplated were estimated at about 200,000 h.p.

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*Chief engineer, Quebec Streams Commission, at general professional meeting, E. I. C., Montreal.

Work of the Quebec Streams Commission

The writer now comes to a field with which he is much more familiar than the subject dealt with above.

The Quebec Streams Commission has done a large amount of work which has made very important power sites considerably more valuable, both in the case of developed and undeveloped water powers. This Commission was appointed in the latter part of the year 1911. Among the duties it was called upon to perform, are the following:

1. To devise just and practical rules, respecting the flow, the drawing off, the disposal, the distribution, the storage and generally respecting the preservation and management of running waters in the Province of Quebec.

2. To consider whether it is expedient to have the rivers of the Province classified as navigable and floatable rivers, and rivers which are not navigable nor floatable, classified by an administrative commission or otherwise, according to uniform rules, and to submit such rules, if it be advisable.

The Commission is formed of three members; one chairman and two commissioners. The chairman is the Honourable S. N. Parent, former Prime Minister of this Province. The two commissioners were, at first, Messrs. Wm. I. Bishop, Civil Engineer, and Ernest Belanger, Civil Engineer. Since the death of Mr. Belanger, Arthur Amos, Chief Engineer of the Hydraulic Service at Quebec, has been appointed commissioner.

The first work which The Quebec Streams Commsision was called upon to do was an investigation of the characteristics of the rivers of this Province and, in 1913, it submitted a report recommending that the said rivers be classed as being public or private property,—according to the area of their watershed. It recommended that the expressions "navigable" and "floatable" be eliminated, that all rivers having a drainage area of three hundred square miles or over should be public property, and that all rivers with an area less than three hundred square miles should be private property.

The most important work which the Commission has performed to date is the regulation of the flow of the St. Maurice river and that of the St. Francois river. In the case of the former river, a complete control of the water supplied by a drainage basin of 3,650 square miles has been established near the head waters of the river. A few details regarding these works and the results obtained therefrom should prove interesting.

The St. Maurice River Flow Regulation

The St. Maurice River flows into the St. Lawrence at Three Rivers, about half-way between Montreal and Quebec. Its drainage area is 17,000 square miles and the river is about 365 miles long. The difference in level between its head waters and its mouth is approximately 1,300 feet. This grade is distributed in a large number of rapids and some high falls, the most important of which are:

The Gres	44 feet
Shawinigan	135 feet
Grand' Mere	40 feet
La Tuque	90 feet
Rapid Blanc	210 feet
Radip des Coeurs	93 feet
Rapid Allard	55 feet

Of these powers, full developments have been carried out at Shawinigan under a head of 150 feet, and at Grand' Mere under a head of 75 feet. At the latter point, the natural fall is 40 feet, but by building a high dam the water is backed up about 25 miles and small falls and rapids are flooded.

Under natural conditions, the minimum flow of the St. Maurice river at Shawinigan was 6,000 cubic feet per second. It reached the absolute minimum of 5,200 second-feet, but for a few days only during the period 1900-1912. Daily records of the flow of this river at Shawinigan have been kept by the Shawinigan Water & Power Company from 1900 to date. As the demand for power was increasing largely, the need of increasing the minimum flow was felt, and the St. Maurice Hydraulic Company, in 1910, built three small storage dams on the Manouane river—a tributary to the St. Maurice river, into which it flows near the Indian post at Weymontachingue, about 188 miles above Shawinigan. These small reservoirs paved the way of the regulation on a larger scale as carried out by the Commission, for they had proved that the water which was let out from these small dams in winter reached Shawinigan with comparatively little loss. This possibility had been doubted somewhat.

Minimum Flow Doubled

In 1912 the St. Maurice Hydraulic Company Limited applied to the Legislature for authorization to carry out a storage scheme in the upper St. Maurice. The Government did not deem it advisable to grant the power demanded, but it decided the Quebec Streams Commission was the proper party to look into the question and carry out the scheme if it was thought desirable. After a thorough examination of the whole question, it was decided to build a dam at the foot of a large series of lakes at a point two miles above the falls called "La Loutre." The construction of the dam was started in 1915 and it was completed in the month of December 1917. The cost of the total scheme, including the acquisition by the Commission of the three storage dams on the Manouane river amounts to $2,500,000.

As a result of the control of the waters by this dam, which is now called "the Gouin Dam," the minimum flow of the river is kept at 12,000 second-feet at Shawinigan. Thus the primary power capacity of the plants at Shawinigan and Grand-Mere has been doubled.

For the benefits derived from the storage, the power companies are paying to the Government an annual sum amounting now to $191,000. This annual revenue will be largely increased when other water powers are developed.

Largest Power Reservoir in World

The capacity of the reservoir created by the Gouin dam is estimated to be one hundred and sixty billion cubic feet, and it is the largest power reservoir in the world—having about twice the capacity of the Assuan reservoir in Egypt. It is, however, exceeded by the Gatun reservoir built in connection with the Panama Canal—the capacity of which is one hundred and eighty three billion cubic feet, but it is only fair to say that part only of this water can be used for supplying part of the Panama Canal. The capacity of some of the largest reservoirs in the world are:

Gatun..	183,000,000,000 cubic feet
La Loutre, St. Maurice..	160,000,000.000 cubic feet
Assuan, Nile..	78,000,000,000 cubic feet
Roosevelt, Salt Lake . ..	52,000,000,000 cubic feet
Pathfinder North Platte..	45,000,000,000 cubic feet
Shoeshone, Shoeshone ..	20,000,000,000 cubic feet

The area of the lakes and the rivers affected by the Gouin dam is two hundred and nine square miles, and with the reservoir full the area of the lake will exceed three hundred square miles. The water is backed up a distance of one hundred and thirty-five miles above the dam.

Power Possibility Increased by 400,000 H.P.

The amount of power due to the storage has been calculated by using the flow curve of the lowest year during the period 1900-1912—that is the year 1906—and the figures arrived at were 32,000 horse-power-years in the case of Shawinigan, and 16,000 horse-power-years in the case of Grand' Mere. It is estimated that the low water power possibility of the St. Maurice river has been increased by about 400,000 horse-power.

The control of the head waters of the St. Maurice river is also beneficial to the lumbering trade in this valley. The flood waters in the spring are not so high and the minimum flow is very much increased. Therefore, the driving of logs down the river may be carried out under better conditions. Water may be supplied for the log drive at a time when it is not required by the power companies and when it is needed to destroy log jams which are formed at certain rapids. For example, this year, (1919), early in July, about one million and a half logs were jammed and aground in the rapid Blanc, about thirty-five miles upstream from La Tuque. The Commission was asked to help the association out of this difficulty by giving a shot of water. The Gouin dam was opened to discharge 13,600 second-feet during twelve days, raising the water to nearly flood conditions. All of the jammed timber was brought out of the rapid and floated down to La Tuque in about two weeks.

River St. Francois

The next storage scheme which the Commission was called upon to study was the partial regulation of the discharge of the St. Francois river, by a control of water supplied to lake St. Francois and to lake Aylmer, both near the head of the river.

Lake St. Francois is located six miles east from the town of Disraeli and about ten miles south-west from the town of Thetford Mines. River St. Francois has a drainage area of 4,100 square miles and drains the largest part of the Eastern Townships. It flows into the St. Lawrence at the head of lake St. Peter and runs through the towns of Disraeli, East Angus, Sherbrooke, Windsor Mills, Richmond and Drummondville. The distance between Lake St. Francois and Lake St. Pierre is about 120 miles, and the slope is practically 900 feet. This slope is distributed through numerous falls and rapids, makin gthe river very desirable for the development of power. In fact, power plants are located as follows:

At Disraeli, St. Francois Water Power Co...	40' head
Disraeli, The Champoux Company.......	30' "
Weedon, City of Sherbrooke	30' "
East Angus, Brompton Pulp & Paper Co. Ltd.	30' "
Bromptonville, Brompton Pulp & Paper Co. Ltd...	30' "
Windsor Mills, Canada Paper Company, Ltd.	16' "
Drummondville, Southern Canada Power Co. Ltd...	30' "

Minimum Flow Increased Five-Fold

By the construction of a dam at the outlet of lake St. Francois, a complete control of the water running from a basin of 472 square miles has been secured, and this water is being evenly distributed throughout the year at the rate of 600 cubic feet per second. The minimum flow from this lake, under natural conditions, has been measured as 100 second-feet. The minimum flow from this source has therefore been increased by 500 second-feet.

Lake Aylmer is located immediately below the town of Disraeli at an altitude of practically one hundred feet below that of lake St. Francois. Its drainage area is one hundred and thirty-five square miles, and its run-off is controlled by a dam at the outlet of the lake near the village of St. Gerard. It has been calculated that this lake will supply one hundred and fifty second-feet above its natural minimum flow.

The dam at Lake St. Francois can raise the water 27 feet above natural low water, and the dam at St. Gerard can raise the water 12 feet above natural low water.

The storage capacity of the reservoir created by lake St. Francois dam is 438 square miles, or 12.2 billion cubic feet. The reservoir is filled up in the spring.

Charges on Second-Foot-Head Method

The cost of the storage scheme on river St. Francois amounted to $700,000. Of this cost, the power owners who reap benefits from the storage have been called upon to pay a yearly rental which covers the interest charges, the sinking fund within a period of thirty years, the cost of maintenance and repairs and a reasonable profit. The amount necessary to cover the above mentioned items is $59,000. The benefits to be derived by each company using the storage water could not be ascertained as no records of the flow of the river were available, and any figures as to additional power due to the storage could only be approximate. In the case of the St. Maurice river, it was different: our calculations were made from complete data. But in this case, to avoid any discussion or litigation as to the benefits derived, it was decided to divide the charges according to the head under which the water was used, multiplied by the increase in the minimum discharge. This is called the "second-foot-head method." It is used by the Wisconsin Valley Improvement Company to distribute the storage charges between the various power companies on the Wisconsin river. For example: the storage reservoir of lake St. Francois supplies five hundred second feet above the natural minimum flow. This water is used by the St. Francois Hydraulic Company under a head of forty feet. The charge of this company would be calculated as being 500 x 40 = 20,000 second-foot-head. The companies which have their power plants located below lake Aylmer receive an additional 150 second-feet and, in the case of the Brompton Pulp & Paper Company, Limited, which uses that water over a head of 85 feet, the proportion would be 650 x 85 = 55,250 second-foot-head. The rate was therefore fixed at fifty cents per second-foot-head. Some of the plant owners have signed contracts and others have accepted the tariff just mentioned.

River St. Anne de Beaupre

A smaller storage scheme has also been carried out in the watershed of the river St. Anne de Beaupre, to increase the minimum flow at St. Ferreol, Seven Falls, where the Laurentian Power Company operates a plant under a head of 410 feet. The minimum natural flow of the river at that point was 165 second-feet; and it is hoped to raise that minimum to two hundred and over. This storage is provided by a dam at the outlet of Lake Brule and gives a control of the run-off from a watershed of twelve square miles only. The Commission is contemplating additional storage on this river.

Other Activities of the Quebec Streams Commission

The other activities of The Quebec Streams Commission have been a complete study of the valley of the Chaudiere river, in the Beauce district, where disastrous floods occur occasionally. On the 31st of July, 1917, after very heavy rains, the water rose 32 feet in less than 24 hours. The Commission has been called upon to make a full report on the possible prevention of such disasters, and this report is now being prepared.

The Commission has also made a complete study of the possibilities of Lake St. John as a storage reservoir. It was found that by a suitable control at the outlet of this lake, it was possible to keep the minimum flow of the Saguenay river at 22,000 second-feet without causing any damage to lands, wharves, etc., around the lake. Such a storage would make possible the development of 600,000 horse-power on the river Saguenay, above the town of Joncquieres. Lake St. John has an area of 350 square miles, and drains a watershed of 30,000 square miles.

Storage on Lake Kenogami

The Commission has also made a complete study of the possibilities of creating a storage reservoir in lake Kenogami, west of the towns of Chicoutimi and Kenogami. This lake has an area of 12 square miles, and there is at present partial regulation under the control of the Chicoutimi Pulp Company. Lake Kenogami has two outlets; one into the river Chicoutimi which flows into the Saguenay river at Chicoutimi about ten miles from Kenogami; the other outlet is through the river Aux Sables which flows into the Saguenay at Kenogami. Lake Kenogami is about 475 feet above the level of the Saguenay river; its two outlets are well provided with falls and rapids. On the Chicoutimi river, water powers have been developed and are being used by the Chicoutimi Pulp Company to operate their large pulp mills. On the river Aux Sables, Price Brothers Limited have developed water powers for the operation of their pulp and paper mills at Kenogami. The cost of storage in Lake Kenogami was estimated at $1,800,000 in 1916, but, under present conditions, it is believed that its cost would be nearly $3,000,000. The question as to whether this work should be carried out or not is now under consideration.

Among the other activities of The Quebec Streams Commission, there is the study of a certain number of undeveloped water-powers, namely on the St. Maurice River, on St. Francois River, on Bell and Harricana Rivers in the Abitibi district, and on the Manicouagan, Aux Outardes and Natashquan rivers on the north shore of the St. Lawrence.

The Commission has also started systematic gaugings of a certain number of rivers in the province. This field of investigation is being enlarged every year and it is the aim of the Commission to extend it over the whole of the Province.

Results of Work Done

Beneficial results have been already obtained through the water conservation policy inaugurated by the Government. Very important industries have located in the St. Maurice valley, namely: at Shawinigan and Three Rivers, owing to the large increase in the power possibilities of this valley. On the river St. Francois, plants are now being constructed at Drummondville, Richmond and Sherbrooke, in which several million dollars must be invested and where two or three thousand hands will be given employment.

As mentioned above, the money invested by the province in the conservation of water is a very profitable investment, not only through the charges which are made to the power companies using the water, but through the industrial prosperity which the said policy will contribute largely to bring here.

The University of Illinois is conducting a short course in Ceramic Engineering, under the direction of the staff of the Ceramic Engineering Department. This course commenced on March 1 and will continue for two weeks. It is designed to meet the requirements of practical men and will deal with the principles underlying the work of managers, superintendents, foremen, burners and others who may be concerned with the manufacture of ceramic products. The instruction is being conducted in a spirit of mutual co-operation and consists of lectures, laboratory work, practice in firing kilns and informal gatherings for question asking.

The Tiffin Wagon Co., of Tiffin, Ohio, have issued a folder illustrating and describing their line of motor trucks. These are built in capacities of 1½, 2½, 3½, 5 and 6 tons. The specifications of each are delineated in this folder and a wide variety of applications are indicated by a number of illustrations.

Messrs. Colthurst & Trace, architects, of 10 Medbury Block, Windsor, Ont., have moved into larger premises and will in future be found at 15 Sandwich St. W., Windsor.

Fixed-Fee Contract for Building Construction

Necessary With To-Day's Mounting Prices—Economy by Co-ordination — Adaptable to Smaller-Sized Jobs

ONE of the most important matters discussed at the recent National Conference on Construction—the annual meeting of the Associated General Contractors of America—was forms of contracts. Representative engineers and contractors presented their viewpoints, each type of contract coming in for its share of approval and criticism. The advantages of the fixed-fee type of contract were presented by F. A. Wells, vice-president of the Wells Bros. Construction Company, in a paper which is printed herewith. The merits of this particular form of contract and its superiorities over other types are delineated in this article, which follows:

Is the general contractor to remain a constructive force in the building industry? We would hardly be attending this meeting were we not certain that the general contractor renders a needed service to the owner and architect and engineer. Certainty of delivery within the set time, reasonableness of the cost of construction, and the carrying out of plans and specifications without undue difficulty to owner or architect in getting that compliance, are dependent upon the existence of concerns such as are represented in the memberships of his association.

An Architect's Viewpoint

Yet there are certain individuals who see this matter differently, and who, noting certain things wrong, believe that the remedy is to be found in the elimination of the general contractor, and the assumption of his duties by the architect. What are some of these difficulties, and what is the true answer? A well-known middle west architect recently stated one side of the question in a letter to an architectural paper. That letter is significant as outlining a definite effort being made to get work done, without the general contractor. It started with the right premises. I do not feel however, that we, as an organization, or as individuals, can agree with the conclusions. Let me quote:

"Curiously enough the architect has little or no direct dealings with the craftsman who executes his designs and the worst of it is that the head contractor is placed in a position in relation to the architect, which is the very opposite of what it should be to secure the ideal results for architecture.

"Our system of letting work by competitive bidding and then placing the contractor in a position where his profit depends largely on doing as little as the contract will allow for the final execution of the work is a vicious system which has always resulted in making impossible that sympathetic co-operation between architect, master builder and craftsman, which must exist in order to secure the best results in the work."

I think little explanation of this statement is necessary. We all know it to be true. It is a clear portrayal of the situation under the lump-sum contract. Regardless of the builder's ability, the amount remaining for profit is little or much, precisely according as the builder is fair or unfair, generous or tight in his interpretation of specifications.

But what is the answer? The author quoted has one idea and we have another. This architect goes on to say:

"An architectural firm with an architect at the head, a master builder and all of his assistants, including a competent force of skilled craftsmen to carry out sympathetically all of the details of the work, would make an organization which, it must be admitted, would undoubtedly be far superior in every way to the organization it is at present necessary to gather together for every architectural problem undertaken."

I submit that the fixed-fee contract is a better solution of the problem. It requires that a reasonable fee be paid for a definite service.

No Need for Architect to Broaden His Scope

Some architects may handle their clients' work through letting all operations to sub-contractors and may accomplish a good result, but there is no inherent necessity for the architect to broaden his scope. If he desires to increase his opportunity of making profit by extending his activities into the construction field it is unquestionably permissible, but to do so he must build a special construction organization able to do just what the general contractor now does, and candidly, most architects would prefer not to be responsible for the larger organization with its certain heavy overhead. In our judgment, after forty years' experience with the various forms of building contracts, the cost-plus-fixed-fee contract, when made with a builder of integrity and ability, brings all that a fair-minded owner can expect or want.

Ability to co-ordinate work is fundamental to economy. It is second nature to the general contractor. While men available to the general contractor are also available to the architectural firm, yet certain jobs going forward to-day, where the architect handles all the work through sub-contracts, show very conclusively the lack of that co-ordination. A structure cannot be erected piecemeal, particularly in the case of concrete frame and floors. The continuance of identical operations over large areas is vital to economy. The synchronizing of sub-contracts is equally important. If the orderly procession of work is not maintained someone is going to lose money or time, or both. The sub-contractor will not take that responsibility. The architect will do his best to coordinate all operations, but the owner holds the bag.

We have, then, merely a merging of architectural and construction activities under one head. That coordination may be entirely successful but it does not argue against the general contractor continuing to operate to the advantage of the majority of owners and also of architects who prefer to remain within their chosen field.

Economy by Co-ordination

Co-ordination means economy, and is dependent upon the absolute dovetailing of all trades represented with each other and partcularly with the main structural elements. The framework could be build at least cost if no cognizance were taken of other trades. If that work is let as a separate contract there will be little sympathy on the part of the builder with delays occasioned by or to other trades. Such delays will be the basis for "extras." The better way is to have the structural frame handled by the same organization responsible for the general co-ordination of all work. Therefore the architectural firm handling construction should do exactly what the general contractor now does. But as a matter of fact, architectural firms do not, except in rare cases, retain any part of the work for their own construction force to handle. Therefore such architect's service does not parallel the operations of the general contractor who does from 40 to 60 per cent. of the work with his own organization and equipment.

But how will this contract meet our critic's objections? He wants the builder to operate with, instead of against, the architect. On the lump-sum basis there is a premium placed upon skinning the job and the multiplying of controverted interpretations of plans and specifications. Remove that premium and the difficulty disappears. The fixed-fee contract does it.

The "ideal result for architecture" consists in obtaining the best possible building at the lowest cost compatible with a reasonable time for execution. Now the best possible building is not reasonably to be expected where the builder can increase his profit by the amount of every omission or undetected substitution. Nor will there be a fine execution of the work where every minor opportunity for betterment of plans and in fact every necessity for change from original layout offers opportunity for extras on which few contractors have ever been known to suffer a loss. Under the fixed-fee plan it is possible to order changes, great or small, with absolute knowledge that the cost will be fair and often without increasing the amount of the fee.

Faults of the Lump Sum Contract

Unquestionably the lump-sum system has many faults. It often gives opportunity for abitrary and unfair rulings against the contractor, in favor of the owner. It kills that sympathetic co-operation between architect, master builder, craftsman and owner, which should exist if the owner is to secure the best results. To revive that co-operation we need only to adopt the fixed-fee principle.

May I quote from another well-known architect writing also in the architectural press and answering a question propounded to the membership of the Illinois Society of Architects. The question was: "Can construction costs be lowered?" We are all interested in its solution. Let me quote him briefly: "On first reading I was inclined to say that it cannot be done . . . . one method occurs to me. The idea I had concerns the letting of contracts . . . . There are two methods, first: Letting separate contracts for each branch of the work on a unit price basis; second: Letting a general contract for the entire work on the cost-plus-percentage basis. The latter method is the one I suggest." Quoting further: "The question is largely one of buying power. The general contractor can buy and sub-let so much cheaper than the architect that he saves not only his own percentage but, in most cases, considerably more.

"The organized contractor's buying power is based on the same qualification as that of any business man who goes into the market to buy goods. He knows values and he knows the market.

"There is still another advantage. The element of divided interest is eliminated. The relation of owner, contractor and architect becomes one of cooperation solely, each striving for the best results at minimum cost."

Thus we have heard from two architects. There is between them no middle ground. With the premises of the former we may agree, and with both the premises and conclusions of the latter we do agree.

Some of our members are strong partisans still of the lump-sum contract and desire the fixed-fee contract to be dropped. I believe, however, that under to-day's conditions the consensus of opinion of this organization, as well as of most owners, architects and engineers, is that the fixed-fee form of contract is wise and necessary.

No Control of Prices

The case might be different if we knew what carpenter labor would cost six weeks from to-day or whether cabinet work included in the contract will be delivered at an estimated figure or at a considerably increased cost, because of the almost impossibility of securing materials. Are contracts for certain materials worth the paper on which they are written? It is my understanding that certain of the smaller material manufacturers in one field have oversold their capacity several times and can deliver but a fraction of what they have contracted to deliver. Will they make good on their earlier low-priced orders or on their later high-priced contracts ? What will we have to pay next summer when excuses take the place of shipments ?

I believe these conditions are sufficient reason for the adoption of the cost-plus-fixed-fee contract by builders; for its approval by architects and engineers, and for its acceptance by owners who are fair enough to expect to pay what their buildings really cost under capable and trustworthy management. We can do our utmost to safeguard an owner against undue cost, but it is not our province to guarantee a cost unless we wish to enter into competition with Lloyd's. On the other hand, were the market falling, surely the owner would desire the advantage of possible lower costs.

Adaptable to Smaller-Sized Jobs

The cost-plus-fixed-fee contract is just as adaptable to smaller sized jobs as to the largest construction work and the smaller contractors who are honest and capable can do work on this basis as readily as the larger contractors. The inefficient, dishonest contractor, whether large or small, will be weeded out, and the standards of the building industry will inevitably be raised to much higher levels than would ever be possible under the lump-sum contract.

To me the vital necessity to-day is for this association to get behind the cost-plus-fixed-fee contract for building construction. General contractors will not lose by its adoption; they have much to gain. Architects and engineers have much to gain. Owners have much to gain.

For neither the owner nor his architect and engineer desires the cheapest building it is possible for a builder to erect under the plans and specifications. But that is exactly what he gets under the lump-sum contract. There can be no such thing as complete specifications. A lump-sum contract is a standing invitation to a builder to skimp the work just as far as he can get away with it.

Of course, a reliable contractor, jealous of his reputation, will not intentionally be unfair, and yet he is not able to look at a problem wholly from the standpoint of the owner if such an attitude jeopardizes his profit. Details not specifically covered in plans and specifications are frequently essential to the success of a building and the builder is not able under a lump-sum contract both to conserve his own interests and comply with the owner's wishes.

On the fixed-fee plan, however, his profit is determined when the contract is signed and from that date he is seeking to erect the building speedily (so that he may release his organization to earn another fee), to erect it according to plans and specifications plus all later expressed wishes of architect and owner (in order that owner may again seek his service) and to erect it at the least cost compatible with the set standard of quality and speed, in order that he may share in the savings. Naturally the architect has an interest in these things. His work need be only that of interpreter, and not of watch dog.

Makes Speedy Erection Possible

Furthermore the fixed-fee contract permits work to proceed on the day the contract is signed. Construction may go on coincidentally with the development of details. If speed is paramount the fixed-fee plan permits saving weeks and often months, required otherwise for completion of plans and specifications, quantity surveys, advertising for bids and final letting of contract. Under the lump-sum contract not one step can be taken until the contract is let on completed plans and specifications. Occasionally a few dollars may be lost to an owner due to the later detailed plans necessitating changes in the preliminary construction, but this seldom occurs.

An interesting comparison of results under the two methods of contracting has come to our attention. Last year, two competing mercantile concerns decided at about the same time to enter a new territory, and service could only start after new warehouses were erected. Two reputable general contractors were engaged, one upon the lump-sum and the other upon the fixed-fee basis. The lump-sum job, almost identical in size with the other, was started first, but is not yet in service. The fixed-fee job was completed and in use in December. Owners of the latter advised architect and builder of the imperative need for speed and the successful outcome was the result, not of greater contracting ability, but of co-operation, trust and confidence on one job and its lack on the other, and the possibility under the fixed-fee contract of beginning work on the signing of the contract, of excavating while foundation plans were being prepared, and of keeping the work throughout, only one step behind the design.

But from the standpoint of the builder (a member of this association) what are the benefits except as we share the satisfaction of owner and architect ?

Do we not render a definite service for which we should be paid ? Is it not well that we know with some certainty what a given operation is to net us ? Is it not legitimate that we put our profession upon a service basis comparable to that of the architect and engineer ? Building contracting firms are notoriously shortlived and the fault is not, we believe, in the lack of business ability so much as the system.

Will Eliminate Dishonest Builder

But a more fundamental reason exists than those previously mentioned. I believe that the reason that this association should go on record as favoring the fixed-fee contract is that it will eliminate from the field the dishonest builder. It will eliminate the organization which has not the ability to do successful work and that elimination will come about through the impossibility of that firm obtaining new business. Its record in the past will stand against it. Reputaton is vital to a builder on fixed-fee operations. It is built up only through years of painstaking effort. It can be wrecked by a single operation. Therefore, dishonesty or lack of ability will promptly place a builder in such a position that he will be unable to stand investigation and, therefore, be unable to operate. There should be no room in the building field for other than able, conscientious builders.

To-day's practice with some builders operating under the fixed-fee plan is to refuse to make preliminary estimates in competition. If owner and architect have not enough confidence and trust to make a contract subject to the builder's making a satisfactory estimate of probable cost, then they prefer not to serve, believing that they can do their best where the fullest confidence is reposed in them.

I sincerely believe that in these times of high building costs we can, through the fixed-fee plan, turn out a building at the absolute minimum cost. Costs are high at best. Legitimate projects are being passed up daily, due to the difficulty of figuring a profit on the use of structures at to-day's costs. Co-operation, identity of interest and early covering in rising markets, permitted through the fixed-fee contract will help toward cost reduction.

Salvaging Old Reinforcing Steel

During the great flood of July, 1916, the reinforced concrete bridge over the Catawba River near Belmont, N. C., was destroyed. In replacing this bridge with a series of reinforced concrete arches and girder spans a considerable saving of money was made by utilizing the steel imbedded in the original wrecked structure. Regarding this the State Highway Engineer for North Carolina, Mr. W. S. Fallis, in his report for 1917-1918, gives the following:

On account of the greatly increased cost of reinforcing steel, as well as its scarcity, and the congested shipping facilities due to war conditions, it was decided to attempt to break up the old wrecked concrete and to salvage therefrom the old reinforcing steel. Very gratifying and interesting results were obtained. It was impossible to let this salvage work to contract, so the counties agreed to furnish the necessary labor and tools, and the work of salvage was carried out under the personal direction and supervision of the Highway Commission's engineer. Over 100,000 lbs. of steel was secured in this way. The concrete was broken with sledge hammers and dynamite; and, strange to say, generally the hammers were more effective than the dynamite. The steel was bent into every conceivable shape, and had, of course, to be straightened out and sorted. It was not found to be damaged in the least. The total cost of salvaging this steel, including the engineer's salary, was only 1¼ cent. per pound, and is considered a remarkable showing. In this way alone, through the assistance of the State Highway Commission, the counties cleared between $3,000 and $4,000 on steel, which they had not anticipated.

Advantages of Permanent Road Construction

Good Roads are an Economic Necessity—Property Values Greatly Increase as Result of Improved Highways

By H. S. Van Scoyoc*

GOOD roads are an economic necessity. This bare statement, a comparatively few years ago would have furnished the text for hours of bitter discussion in almost any gathering at which it might have been introduced. To-day it is a proposition which would receive the unanimous support of any meeting. This result has been brought about by the most satisfactory method of proof possible, for good roads have been built in many sections and the results have convinced the most skeptical. They have reduced transportation costs; they have enlarged social intercourse; they have improved educational opportunities; they have increased rural church attendance; they have even saved human lives by bringing the physician nearer to his patient.

What has become of the fear that paying for them would bankrupt the community? Who pays for good roads? Good roads, like good advertising, pay for themselves. Good roads do cost money, but they save out of all proportion to their cost. To be more concrete, let us examine the Toronto-Hamilton highway, the cost of which was a very live subject about four years ago. Approximately 40 per cent. of its cost is borne by the Provincial Government out of consolidated revenue, but the ultimate source was the motorists' fees. Speaking in Toronto recently Mr. A. W. Campbell, director of highways, Ottawa, said that improved roads would save annually approximately 20 per cent. of the investment in motor vehicles. He included reduced fuel consumption and reduced charges for upkeep of vehicles. The motorist is a willing contributor for road improvement and he can afford to be if he gets his money's worth in satisfactory construction.

A Means of Linking Towns Together

The cities of Toronto and Hamilton, together, contributed 30 per cent. of the cost. In bad weather Bronte is now nearer Toronto, as far as time is concerned, than New Toronto was before construction began. Farm produce from the Grimsby section is hauled direct to the Toronto market, and Hamilton has one of the best, if not the best, farmers' markets in Canada.

Just at this time, when the larger Canadian cities feel that they are called upon to contribute too large a share of provincial funds, the experience of Detroit, Mich., may be interesting. For road taxation purposes Detroit is part of the county of Wayne, and pays in direct proportion to assessed valuation. On October 1, 1906, when Wayne County began its county road system, the total county valuation was $418,070,750, of which Detroit's share was $355,363,747, or approximately 85 per cent. On October 1, 1915, the total valuation was $694,158,333, of which Detroit's share was $558,043,950, or only 80 per cent. In other words, while the valuation of Detroit during a period of phenomenal growth, increased by 57 per cent. the valuation of the townships in the same period has increased by 117 per cent. In addition, the city had annexed some of the most desirable township property. Detroit has thus found a satisfactory way to reduce its share of the burden.

Counties on the Toronto-Hamilton highway pay approximately $6,000 per mile. In some cases the charges are actually less than the county paid for maintenance of less durable types previously. In all cases increased assessments will place the carrying charges in reality upon the taxpayers whose properties have been improved. The townships pay $4,000 per mile, which may be assessed on property adjoining the highway, or over the entire township or by a combination of the two methods.

In any case the cost will largely fall on those directly benefiting. Farmers, six miles away, have hauled their produce to wayside markets along the highway. In at least one instance the townships' share has been placed on the entire township, but in any case the individual property owner is meeting his share of cost willingly.

Good Roads Increase Property Values

One owner writing on January 22, 1920, says:

"Property along the Hamilton and Toronto Highway, in the locality where I live, has increased enormously in value in the past seven or eight years, durin which time the highway was first discussed and finally built. For instance, land lying between the road and the lake has jumped, I would say, from an average of three to five hundred dollars an acre to an average of from four to six thousand per acre. One definite transaction is the Crystal Beach, which immediately adjoins my farm. This property, which lies between the road and the lake, running in depth from three to four hundred feet, consists of a little over eight acres. It was purchased in 1911 for $4,500. All of the lots into which this property was sub-divided have been sold, and quite a number which changed hands during 1919 sold for $1,500 or better per lot. Figuring the average of these lots this is at a rate of between $5,500 and $6.000 per acre.

Further back, on the next concession, along which the radial line runs, a number of parcels of five and ten acres were sold last summer at prices a little better than $500 per acre. This was bare land without trees or buildings, situated about two-thirds of a mile back from the highway. Any amount of land along that road could have been purchased eight years ago for between $100 and $150 per acre."

"Hard to Compute the Saving"

On January 17, 1917, a Clarkson farmer wrote the Commission saying, in part:

"I have much pleasure in expressing my high appreciation of the value of the road to the residents of this section of the township. Being one of the principal objectors to the building of the highway on account of the damage I thought it would do to my property, it is only fair to say that the way the frontage has been improved has made my place much more valuable, while the road itself is of incalculable value to me as a fruit grower; for example, this year my only cost for wagon repairs has been the setting of the tires, while formerly the expense of keeping my wagon in running order has been as high as fifty or sixty dollars. I am able to take large loads of produce to Toronto without tiring my team, and save several hours on the way, as well as the large expense of shipping by express and the commission for selling, and it would be hard to compute the saving in dollars in one season."

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*Manager of Publicity, Canada Cement Co., Ltd., formerly Chief Engineer, Toronto-Hamilton Highway Commission, address before Brantford Rotary Club.

Speaking before the Ontario Good Roads Association on March 1, 1918, Mr. R. H. Lush said: "I happen to be on the Toronto-Hamilton highway, where we now have a frontage tax of a cent and a half per foot and every ratepayer on the road is quite willing to pay for it." When the chairman asked: "Would you pay twice a cent and a half per foot rather than be without the road?" he replied: "Certainly, I pay quite a bit now, but I would not be without it. I think it will be worth many thousands to me when I want to sell my property. Not only that, but I can now go to market with my produce with ease and when you consider all the advantages it is a 'cinch' to pay frontage tax."

Another property owner, writing January 27th, 1920, says: "Land values have undoubtedly increased since the construction and completion of the highway. Of couse, you will realize that one of the reasons for the increase, especially of these portions adjacent to the lake, is the fact of their having lake frontage, which makes it desirable from a standpoint of summer homes for city residents, and as a great number of the better portions are gradually being picked up, the remaining parts are increasing in value. East of Burlington, land is now being held at anywhere from $20 to $30 per foot frontage. I made a sale last fall of a portion of my farm, fronting on the highway and running back to the lake shore at $30 per foot. I understand that Mr. ——— sold a certain frontage at $25 per foot last year. Mr. ——— bought a nine-acre holding from Mr. ———, just east of Appelby Road, and paid in the neighborhood of $25 per foot. Several Crystal Beach lots changed hands at about $35 per foot. The cost has not been a cause for worry since the advantages have been seen."

High Class Construction

A road which is better than its predecessor will win for itself warm friends and supporters, but there are certain conditions of traffic and surroundings which justify high-class construction. It has been possible for me to secure figures concerning contracts awarded in 28 States of the United States during 1919. These figures refer to state contracts only, no county or township contracts being included.

Including only those mileages where some form of surfacing was applied, a summary of road construction shows that of 4516.76 miles placed under contract in 1919: 2455.58 miles were cement concrete; 395.96 miles were bituminous concrete; 88.83 miles were sheet asphalt; 254.05 miles were brick; 0.20 miles were stone block; 0.30 miles were asphalt block; 344.95 miles were bituminous macadam; 224.51 miles were macadam; 752.38 miles were gravel. It is significant that 3194.92 miles or more than 70 per cent. of the total is for a type higher than bituminous macadam. The cement concrete road yardage, exclusive of streets and lanes placed under contract in the United States during 1919 totaled 40,453,337 square yards, equivalent to 3,830 miles of road, 18 feet in width.

There are some good reasons for this preponderance of high-class construction, comparatively high in first cost, viz., saving in tractive effort, saving in fuel, and saving in maintenance.

Saving in Tractive Effort

In 1917 the Good Roads Bureau of the California State Automobile Association conducted a series of tests showing the pull in pounds per ton required to move a load over various types of unimproved and improved highways.

The results are summarized as follows:

Pull in Pounds per Ton

Over a level, unsurfaced concrete	27.6
Concrete base 3/8 inch skin top asphaltic oil and screenings	49.2
Waterbound Macadam level, good condition..	64.30
Concrete base 1½ inch Topeka top level, good condition	68.50
Gravel road, good condition, level	78.20
Earth road fine dust level	92,00
Earth road, stiff mud on top, firm underneath, level..	218.00
Loose gravel, not packed down, new road, level...	263.00

Saving in Fuel

The White Company. Cleveland, in co-operation with The Portland Cement Association, conducted a series of tests on various types of highways in the vicinity of Cleveland, Ohio. These tests were made in the fall of 1918 during cool weather. Five two-ton trucks loaded to capacity were run repeatedly over various sections of paved and improved roads. The average mileage per gallon of gasoline is shown by the following table:

Earth..	5.78	miles per gallon
Fair gravel..	7.19	" "
Good gravel	9.39	" "
Fair Bituminous Macadam....	9.48	" "
Fair Brick..	9.88	" "
Good Brick..	11.44	" "
Concrete	11.78	" "

In the Iowa State Highway Commission Service Bulletin for September, 1919, are given results secured from tests made by the Good Roads Section of the Engineering Experiment Station of Iowa State College, at Ames. A heavy aviation type army truck with a gross weight of truck and load of nearly eight tons is being used in the series of tests. The gasoline consumption has been reduced to an equivalent level road so that the effect of any grades that might occur has been eliminated.

Kind of Road Surface	Miles per gallon	Ton-miles per gallon
Ordinary gravel	2.22	17.8
Gravel in excellent condition	2.66	22.42
Bitulithic	2.86	22.8
Concrete in good condition	3.83	30.64
Monolithic Brick	3.84	30.72

Maintenance figures are likely to be misleading unless all of the conditions are known. Sometimes only surface maintenance is included. In other instances cited details will be given as far as known:

State of Washington for Year 1918

Type of Surface	Mileage	Cost per mile
Brick pavement—Excessive brick costs due to extensive replacements made necessary by roadbed settlement etc.	8.81	$755.08
Concrete	102.38	111.61
Asphaltic Concrete	23.24	338.68
Bitulithic and Warrenite	17.77	289.45
Sheet Asphalt	5.97	34.68
½ width Concrete and ½ width gravel and macadam	8.53	288.61
Bituminous Macadam	40.06	490.03
Waterbound Macadam	125.05	418.52
Crushed Rock Surfacing..	66.30	483.61
Gravel Surfacing	825.81	428.48

The cost figures include all expenditures reported upon the highway, its roadbed, drainage facilities, surfacing or pavement; also apportionment of costs of equipment, supplies and supervision.

Figures Published in Ohio State Highway Report, 1916

Type.	Mileage	Cost per mile per year
Concrete..	203	51.00
Brick	381	105.00
Gravel..	40	194.00
Macadam	731	263.00

Maintenance Cost in New York 1915 to 1918

Type	Miles maintained	Average Cost per mile per year
Bituminous penetration	2793	$490
Gravel	173	843
Waterbound macadam	2451	911
Brick..	284	210
Cement concrete	208	138
Second class concrete	291	938
Mixed method bituminous on concrete	89	356

Commissioner Greene, of New York, says 80.48 miles of macadam roads which were built in 1912, at an average cost of $11,874 per mile, had cost by Jan. 7, 1919, an average of $8,723 per mile for maintenance, the average maintenance per mile per year being $1342.

Toronto-Hamilton Highway Costs

Toronto-Hamilton Highway expenditure on concrete macadam road—surface only—for labor, materials and superintendence is given in the following table:

Concrete

	1916	1917	1918	1919
Miles in service	16 miles	31 miles	36 miles	36 miles
Chiselling joints	$512.34	$948.28	$581.14	
Tarring cracks and joints	377.05	767.70	1614.45	
Total maintenance cost...	$889.39	$1715.98	$2195.59	$1726.68
Average cost per mile...	55.59	55.35	60.99	47.83

Macadam

	1.17 miles	1.70 miles	1.70 miles	1.20 miles
Surface treatment .. .	$1256.16	$6140.36	$9726.98	$7491.90
Average cost per mile	1073.63	3611.97	5721.75	6243.25

The average cost per mile, per year, thus works out as: Surface treated macadam, $4265.85; cement concrete, $54.81.

A study of the haulage costs and upkeep charges will serve to explain the present tendency in main highway construction, where experience is being crystallized into action. There is still a better and a loftier reason for high-class construction. It makes for a higher type of citizenship. In 1916, when Chief Engineer of the Toronto-Hamilton Highway, it was my good fortune one day to have dinner in a farm house fronting on the highway. Over our final cup of tea I said to the good lady of the house: "What do you think of the new road ? I will never forget her reply: "Words cannot tell what it is doing for us. We have lived here for twenty years, ever since we were married. Our children are growing up here. As you know, this road was not previously the most travelled. On account of the heavy sand it was avoided in dry weather, but was the only possible road when rain made the clay stretches on Dundas street impassable. Travellers were few. We used to huddle by the window in the front parlor and carefully peek out under the shades to watch them go by. Their heads were down. If it was necessary to turn out to pass another rig we had to close our ears to keep out the burning language. They cursed the country, the province, the county, the township, the farm. We were ashamed. But now hundreds go by where one went before. Every one is sitting up straight with a smile on his face. We sit on the front balcony and enjoy the cheery greetings. When they pass another rig there is a wave of the hand; often we hear "A fine day," "a dandy road," "best crops we have ever seen." We are proud of our farm, our township, our county, our province, our country." That is the spirit that will make our country great.

Let us say with Ruskin: "Therefore when we build, let us think that we build forever. Let it not be for present delight, nor for present use alone. Let it be such work as our descendants will thank us for, and let us think, as we lay stone on stone, that a time is to come when those stones will be held sacred because our hands have touched them, and that men will say as they look upon the labor, and wrought substance of them: 'See this our fathers did for us.' "

Sewage Problems of York Township, Ont.

This Municipality Has Peculiar Problems Owing to its Proximity to Toronto—Considerations in Design of System

By J. M. M. Greig*

THE Township of York, Ont., almost encloses the city of Toronto, consequently there was at one time a rapid growth of houses and streets in the township areas immediately adjoining the city limits. The people on the margin expected to obtain water supply, sewers, gas, etc., from the city and the tendency up to a certain stage was to look for all improvements in that direction. A few streets in the township have been sewered in the last few years and these sewers have their outlets in the adjoining city sewers.

The populous parts of the township are now no longer the mere margin of the city, but the population has spread itself out to such an extent that the time has arrived for the township to look into the possibilities of sewering the whole area. In consequence the township council called for a preliminary report on a comprehensive sewer scheme for the township.

Mr. R. O. Wynne-Roberts, who is affiliated with Mr. Frank Barber, the township engineer, has prepared a preliminary report on the whole area, and this paper read last Thursday before the Toronto Branch, E.I.C., gives some notes on the methods adopted in the preliminary investigation of the possibilities of the comprehensive sewer scheme.

Township Tied in With City

Generally speaking the greater part of the township slopes towards Lake Ontario. The next most important slopes are those towards the rivers Humber and Don but the general trend of part of the Western area is cut into by creeks which rise in the high ground and run diagonally from northwest to south-east right through the city. The city and township meet, not on any natural watershed or stream course but along arbitrary lines, which are the outcome of real estate subdivision.

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*Read before Toronto Branch, E. I. C.

The township of York almost surrounds the city and the streams rising in the township flow towards the lake through the city. The effect of this is obvious. It means that many parts of the township must be sewered against the natural grade if they are to be kept clear of the city. The Black Creek watershed, Swansea district and the small section north of Danforth and east of Woodbine Heights are the only localities in which it is possible to drain naturally away from the city.

It is not the object of this paper to deal with the actual reports submitted to the Council, but rather to state the methods adopted in arriving at the data for these reports. Districts and boundaries may therefore be left out of consideration for the present.

Residental District; Population not Dense

The first consideration then is the quantity of sewage to be dealt with. The township is broadly speaking a residential district and the population is not likely to be dense. Forty persons per acre using 80 gals. of water per day with half of this drawn off in 8 hours gives a flow per acre of something less than one one-hundreth of a cubic ft. per second. One one-hundredth c.f.s. was taken as the figure for sewage. It was possible to design a scheme dealing with sewage alone with comparatively small pipes, and at first sight this would seem the obvious plan for the township in its early stages of development. One difficulty which confronted us was the flat gradients required to get out of the valleys sloping towards the city.

It was necessary in some cases to take the trunk sewers through the ridge dividing water sheds at, of course, great depths. Though small diameter sewers would carry the sewage on reasonable gradients, when working against the disadvantages mentioned, much larger diameters were necessary, with the consequent increase in cost. These disproportionately large sewers would have too low velocities and would likely cause much trouble by prolonging the time the sewage must remain in the sewer. These considerations caused us eventually to abandon the idea of a separate system of sewers for most of the scheme.

Allowance for Rain Water

In the separate system no allowance is made for rain water from roofs of houses, so, unless the householders have rain water cisterns and take advantage of this supply of soft water, flooding will occur on the lawns and yards. If water is admitted to the sewers from the down pipes the conditions are naturally changed. The sewers would receive benefit from the flushing caused by the increased quantity of water during rainstorms which would be of assistance where the grades are flat, but on the other hand, the sewers would now have to be much larger.

Investigation showed that 6 or 7 houses was a fair average per acre, and the area of house roofs would then be .075 of the total area. With a rainfall intensity of 1.6 inches per hour the runoff from roofs would be .12 cu. ft. per second per acre, that is, 12 times the dry weather flow. This "roofwater and sewage" in the same sewer looks a pretty good scheme for a developing district, but like the "sewage only" scheme it is not a final solution. There is still the storm water from roads, lawns and back yards to deal with.

Taking Care of Storm Water

As a district gets built up sidewalks are laid, pavements put down and the proportion of land which will absorb rain as it falls becomes less. In time every heavy rain fall will mean flooded ground. How is this to be dealt with? The trunk systems of the sewers might be paralleled by additional trunks or relief sewers, which would receive from the original trunks by overflows such excess rainfall as they could not carry, but the lateral sewers in each individual street would not be large enough to deal with the rainfall were connections to be made to them from the catch pits, etc. So to deal with the storm water in addition to the sewage and roof water it would be necessary to have a second sewer in each street. These storm sewers might be laid in shallower trenches and so be less costly, also their installation might be delayed for a good many years and so keep down the initial capital charges, but on the other hand pavements would be cut up by them and house connections already in, might, in crossing coincide with the adopted grade of the storm sewer and cause much trouble. There is also the danger of house drains being connected to the wrong sewer. Where a district slopes toward a stream, into which storm water can be discharged at many points of its course, that is to say, where nearly every street running towards the river could deliver its storm water into it, probably a seperate system would be the least costly, both in the developing stage and ultimately. In York township the conditions are not very favorable to this system for in most cases the outfall for storm water would be into the city area into which it now flows from the land.

Overflows for Certain Areas

In the district east of the Woodbine Heights, in the Black Creek area, and in the Swansea district, it is possible to keep down the size of the main trunks by overflows at certain points with short relief sewers taken from these overflows, to the stream.

In the lower Black Creek area immediately adjoining the creek and in the lowest parts of Swansea where the lack of fall compels the use of pumps, sewage only is dealt with in the present proposal as these areas lend themselves to the separate system and short storm sewers could deal later with any part likely to be flooded.

A few reasons have been given for the adoption of the combined system and now it is necessary to ascertain what we may expect in the way of rainfall and runoff.

The volume of storm water will be so large as compared with the sewage flow that it is, in most cases, unnecessary to consider sewage except from one angle, namely that of fixing gradients, so as to make the sewers self cleansing with dry weather flow.

Rainfall Data

Until comparatively recent times rainfall gauges simply recorded the total fall and if they were examined daily, the record taken was that of the precipitation for each day, usually stated in inches. This information is very useful in estimating the monthly or yearly yield of a catchment area for water supply or power development, but it is not of much use in sewer design. The object of a combined system is to get rid of the surface water as soon as possible and so prevent flooding.

Land in a natural state with a fair slope permits the falling rain to flow off in a film over the surface to the streams, and it also absorbs a great quantity which percolates directly into the soil, but with paved areas etc., as in a city, less absorption takes place, the surface film is barred by artificial objects and the result is roads are converted into rivulets and flooding takes place in numerous localities before the water can reach the natural outlet in the stream. The point then is not what is the total rainfall in a day but rather what happens every five minutes. Many cities now have self-recording rain gauges which give rainfall over short periods. From these we find that some storms may be so intense that ½ inch falls in one particular five minutes, that is, at the rate of six inches per hour. A total precipitation of 6 inches in 24 hours is a very severe storm. Taking these short period gaugings, maximum rates have been found for 5 minutes, 10 minutes, etc. and so on, over a period of years. The highest rainfall occurring in each year or period of years has also been found and from this information it is possible to say, for instance, that every five years there may be a storm intensity of 4.7 inches per hour for a period of five minutes.

Definite figures for rainfall are readily obtained but it is hard to estimate the amount of runoff, as so much depends on the state of the surface on which the rain falls. In a residential district about 30% of the total area will be impermeable when fully developed. The remaining 70% of the area will, at the start of the storm, absorb a good deal of the rain and the roughness of the lawns, etc., will hold up a fiilm of water and act as storage tanks delaying the progress of the water towards the sewers. Only very careful gauging of existing sewers in conjunction with short time rainfall measurements will enable us to solve the problem of runoff.

Rain falling at the rate of 1 inch per hour if all collected would mean a rate of runoff from one acre of nearly 1 cu. ft. per second. The coefficients of run-off are roughly 30 per cent. of the rain fall for the first 20 minutes; after 20 minutes, some allowance has been made for the flow from the previous area, as by this time it is probable the ground will be so soaked that the surface run-off will be considerably increased. A table of run-off coefficients gives a ready method of estimating the quantity of water to be dealt with, but in using these it is necessary to know the time of concentration for each point in the sewer.

Determination of Run-off

In some instances the quantity of run-off has been worked out on the principle of applying the rate of rainfall corresponding with the time of concentration at each point in the line of a trunk sewer. Thus, if the storm water took ten minutes to reach a certain point, then the area tributary to this point in acres was multpilied by the rainfall rate for a ten minute storm and reduced by the percentage of impermeable area. By plotting the results arrived at in this way for a number of sewers, a curve was obtained which gives directly the run-off to be expected from any acreage. With this curve it is possible to estimate the run-off from any acreage without going into the time required for water to flow through the sewer.

A graphic method of working out the probable quantity of storm water in a trunk sewer was suggested by Mr. Wynne-Roberts. Without going into details the object of these diagrams is to show how it is possible for the flood from one branch to have passed a particular section before that section receives the peak load from another branch sewer. This diagram has been worked out for storms of 5, 10 and 20 minutes duration from one district.

All the proposed sewers in the York Township scheme have been worked out on the "Rational Method" taking the time of concentration into account and their sizes fixed by the quantities arrived at in this way. When it comes down to making working drawings it would be well to try out each trunk by the diagrammatic method.

Mapping

Plans to a scale of 200 ft. 1 in. were prepared and contours drawn on them from lines of levels run on street lines. A study of the contours brought out the best lines for trunk sewers and then the direction of flow of all laterals was indicated on each street, the watersheds being thus defined. Every street intersection was given a number. The information on these plans was then transferred to a calculation sheet with headings: Street, name, from, to, distance, length (for area) width (for area), surface elevations. From this the acres tributary to each section can be worked out. The surface elevations give an indication of the gradients available. The elevations for the inverts were entered in the table as if the sewers were lying on the surface of the ground or near to it, so that at a glance it was observable how nearly the adopted grades paralleled the surface. After working through the calculations in this way, it was only necessary to take 10 feet off of all elevations to arrive at the real invert levels. It was possible by taking the data from the plans into the calculation sheets to settle the gradients and sewer sizes without further reference to the plans or plotting of any profiles. Of course when working drawings are got out, profiles will be used and probably many minor modifications and improvements made on the gradients.

Financial Considerations

The report sent in is purely a preliminary one, but having built up this general scheme it is possible to try out various modifications with some idea of how they will effect the building as a whole. In a sewerage scheme comprising many drainage areas, artificial and natural watersheds contiguous to one another, it is a very intricate problem to arrange the design so that they are in co-relation. Whatever you take from one area must be added to another with the corresponding changes made in sewer sizes, etc. involved thereby. The most serious problem is to so design the sewers that they will serve the present needs without an undue financial burden and yet form part of a greater scheme capable of taking future requirements. This side of the problem will need further study and it is possible we shall find a financially sound policy to lay down certain portions of trunk sewers now, the capacity of which will be quite inadequate for final conditions, and arrange to parallel them, possibly ten years hence, with relief sewers. The history of a great many cities has shown this to be the method actually carried out, but how much of this was due to lack of foresight and how much to financial considerations we cannot tell.

It is to be hoped that the town planning authorities will exercise their powers to prevent promiscuous

(Continued on page 207)

Developments in 1919 in the Uses of Machinery for Highway Construction

Progress Made in Determining Types of Plant Adapted to Rapid and Economical Construction—Use of Motor Trucks and Tractor-Trailers for Material Haulage Increases

MACHINERY was more widely employed last year and in larger plant units than ever before in highway construction. Due to experimentation, unskilled direction and lack of experience in selecting plant, the results were not definite. Toward the end of the season, certain general conclusions began to be drawn. Experience had indicated which types and arrangement of equipment gave the better results. Nevertheless, highway builders will not find in the year's experience a definite answer to any specific question, not even to the question whether extensive machine equipment is wise.

The season, however, did advance highway construction plant practice in one respect: it pointed out the need for more careful co-ordination between the various items of plant, the introduction of the factory idea. In other words, it directed attention to the plant as a whole, rather than to individual machines or items of equipment. In addition, it helped to establish a broad classification for types of highway plant; it emphasized the importance of skilled direction of operation, and showed up weakness in plant design. This development is described by C. S. Hill in Engineering News Record from which this article is reprinted.

Broad Lessons Learned

In general, the chief advance of the year was the emphasis, above referred to, on the development of complete road-building plants. There was little new in the development of machines as such. The power finishing machine, which came nearest being new, was old, though not previously widely used, and so were other devices that in the last year were generally considered novelties.

Despite the fact that the chief advance of the year was in the direction of properly co-ordinated plant, the impression must not be given that there was universal appreciation of the idea. There was progress, however, in getting it accepted, and this progress was due to two circumstances: The adoption of large-mileage contracts and the extensive entrance into the field of large general construction companies. The large contract provided the opportunity and, perhaps, the need, and the large contractor posessed the necessary capital.

Progress during the year in determining the best types of plant, like the progress in the co-ordinated plant idea, was partial. Four general types were used:

1. First in order of use and in the perfection with which the details had been worked out, was industrial-railway haulage of batches loaded at a central proportioning plant and charged directly to mixers traveling the subgrade.

2. Stationary mixing plants with long-distance haulage of wet concrete on to the subgrade.

3. Portable mixing plants, moved to widely spaced stock piles in succession, with short-distance wet haulage onto the subgrade.

4. The long-familiar paving-mixer outfit charged by wheeling from continuous stock piles on the subgrade.

Classified according to the magnitude of the operation, the first type led, followed closely by the third type; these were the popular plants for large operations of 10 to 20 miles of road, and were in general use for smaller operations also. Generally, the second and fourth types were confined to contracts of about five miles and never to those exceeding 10 miles.

Classified according to magnitude of investment, the first type of plant led in cost, with the second and third types close seconds and the fourth type well in the rear. Classified according to the number of units and the necessity for their close co-ordination, the types ranked about in the order in which they have been numbered. Classified according to general utility of the equipment, the order was about as follows: The first type of plant had the fewest major units which were suited to other operations than highway construction, the fourth type followed, the third came next, and the second type had the greatest number of units which could be used for general construction.

Based on last year's records, which is unfair for reasons which are indicated further on, none of these plant units demonstrated great superiority over the others in average output for a season.

Large Versus Small Plants

The fact that under last year's conditions the small outfit suffered so little in comparison of output with that of the large plants, draws attention to the need for skilled management. Let it be clearly understood that in thus comparing outputs of small and large plants, the latter exhibited much greater rates of output, but little, if any, greater averages. Better management of the smaller plants was possible under the conditions of acute materials shortage. They could be operated to full capacity when the large plant could not. They could be operated at part capacity at less cost per unit of production. This did not prove that the large plant was inferior; it merely demonstrated that large-plant conditions were necessary for successful large-plant operation.

In emphasizing the conditions required for the use of large plants, last year's experience performed its greatest service to the contractor. These requirements are:

1. Materials supply always equal to the output capacity.

2. Exact co-ordination of plant units in speed and capacity.

3. Precise routing of materials on the work.

4. Rigid maintenance of all machines in working order.

5. Planning ahead of operations, and

6. Complete recording and analysis of methods and results.

Experience last year, furthermore, made plain the fact that unless these conditions are assured, large-plant construction outfits will fall short of their possibilities and may prove unwise.

To recapitulate, the year's far-reaching developments in machine construction of highways were: Extension of the practice of the factory idea of co-ordinated equipment; broad definition of successful plant types, and emphasis on the importance of skilled direction of plant operations.

New Machines and Operations

Strictly speaking, no new road-building machines were developed. Several were new in the sense that they were generally used for the first time last year. Outstanding among these is the power compacting and finishing machine for concrete slabs. For quick reference, the machine development of the year may be considered under: Grading and subgrade preparation; unloading and proportioning of materials; transportation of materials; charging materials and mixing; placing and finishing pavement.

In heavy grading, tractor operation of plows, scarifiers, and grading machines was noticeably increased. The development of a definite practice of substituting tractors for horses in all operations requiring more than one team appeared. With tractor operation an indication also was had of the need for strengthening machines for uprooting and cutting down hard packed material like old macadam and gravel surfacing. For light grading or subgrading preparation there was an increased use of machines for fine finishing in order to meet the growing tendency of specifications to call for profiles exceedingly close to theoretical lines and surfaces. In some specifications ⅛ in. was the variation permitted. In design of novelty, the subgrade finisher or planing machine stood out most prominently. This machine rides on steel side forms set ahead accurately for slab construction, and is handled by a road roller or tractor, with skilled operation, the fresno scraper was another successfully used device for close finishing.

Loading-plant practice in 1919 indicated that the ideas of contractors were still rather jumbled. Stationary elevator bins, travelling bins, and stock piles over tunnels, both surface and subsurface, were used about equally, with both locomotive cranes and derricks, and both large and small buckets for unloading. Toward the end of the year, favor leaned to the elevated bin plant. A growing inclination toward traveling bins as advantageous in cutting down switching and shunting operations was also apparent. Bulk handling of cement was the successful loading plant experiment of the year. The experience of several contractors demonstrated the practicability of (1) safe shipment in open top cars with tarpaulin covers; (2) unloading without waste by clamshell buckets; (3)storage in open top bins with tarpaulin covers; (4) charging by measuring chutes without excessive dusting. Careful planning of material handling appliances is sufficient to make the use of bulk cement entirely practicable in highway construction, with a consequent material saving, if the limited experience of the year is a safe criterion.

Job transportation of materials was demonstrated anew by the year's experience to be the crucial task of modern paved-road construction. There were three types of haulage operations: (1) Haulage of raw materials to stock piles in the grade; (2) of dry batch from loading plant to mixer; and (3) wet batch from mixing plant to subgrade. Each of the three operations presented its special problem.

Increased use of motor trucks and of tractors with trailers was the year's new development in hauling material to stock pile on the grade. Success was dependent upon road conditions. Dirt roads in wet weather put the large-load, heavier vehicles virtually out of commission through reduced speed even when the machines were not stalled. This led as experience was gained, to the use of lighter trucks. The question whether light trucks, through greater ability to travel soft roads, might not increase the number of trips sufficiently to excel in haulage performance the larger, though slower, heavy trucks, was raised by the year's experience.

Dry-batch haulage to the mixer from a central loading plant, through the use of industrial-railway plant, was general. Gasoline locomotives were the motive power. Batches were carried in boxes on flat-cars or in car bodies removable from the trucks. In detail, the approach to a standard was not so close. Weight of locomotive and of truck, length of trains and size of batches, showed a great variation. The manifest haul was, however, less a lack of uniformity than one of capacity. To operate the modern three-bag batch or large mixer at full capacity, greater speed was found necessary in carrying materials, and a demand for heavier equipment developed—for six-ton in place of three-ton locomotives; for 25-lb. instead of 20-lb. rail; for 20-car to 30-car trains instead of 10-car to 20-car trains; and for 15-mile speed instead of eight-mile speeds.

Realization of the vital importance of thoroughly equipped industrial-railway plant, and its efficient operation, was the outstanding feature of the year. As employed on fast road work, the industrial railway is in miniature a modern commercial railway with intensive traffic. Train schedules, train loads, running speed, accident prevention and maintenance are essentials that must be planned, and the plan must be flexible to meet emergencies. The job of traffic manager is a position which this year's experience with industrial-railway haulage has raised to prime importance.

Wet-Batch Haulage Possible

Wet-batch haulage was demonstrated by the year's operations to be an important possibility. Two means of transportation were successful—motor trucks for long hauls and truck-tractors for short hauls. With hauls up to two miles no trouble was experienced in getting the mixture onto the grade without segregation or preliminary set. The disadvantages which were most evident were: (1)That hard roads are essential to continuous motor-truck operation; (2) that motor truck travel over finished subgrade necessitates a second finishing and rolling, and (3) that pumping and road side pipe lines continue necessary for curing the slab.

Toward the end of the year studies of plans for obviating these disadvantages had made progress. Wet-batch haulage by industrial railway was an obvious thought. This plan met the first two disadvan-

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Canada's Contractors—L. E. Dowling

In regard to building prospects in Canada, Mr. L. E. Dowling, general contractor of Toronto, cannot help but feel optimistic. He has great faith in the construction industry and feels assured that for many years to come, Canada will experience an activity that will be unprecedented. He bases this forecast on an intimate knowledge of business conditions which he has acquired as a general contractor for a great many years. Mr. Dowling is not a Canadian by birth, but he has been so long with us and he has such faith in Canada that we can now regard him as a Canadian. He was born in the United States and educated along technical lines, obtaining the degree of C. E. For about four years he was employed in railway construction for the New York Central and Baltimore & Ohio Railways. After this railroad experience, Mr. Dowling was with the Bureau of Filtration of the City of Pittsburgh during the building of their $8,000,000 water purification system. After three years in this connection, he was with several Pittsburgh construction companies and was engaged in various parts of the United States as their representative. It was while with the Heindeman-Henderson Company, with which concern he had been in turn, engineer, estimator and superintendent, that he came to Toronto, eleven years ago, as superintendent of the construction of the Standard Sanitary Manufacturing Company's plant at Royce and Lansdowne Avenues. Following the completion of the job, he stayed in Toronto and has engaged in industrial work almost exclusively, and has handled a great many warehouses and manufacturing plants of various descriptions, among these being the manufacturing plants in Toronto of the Canadian Bag Company, United Drug Company, Hoyt Metal Company, and the American LaFrance Fire Engine Company. In Montreal he has done work for the Consumers' Cordage Company and the Canadian Bag Company, and at Halifax he was engaged in the re-construction of the Consumers' Cordage Company's plant which was an example of particularly speedy construction. At the present time, Mr. Dowling is handling, among others, a new ice plant for the Lake Simcoe Ice Company; a manufacturing building for Henry Greisman and a new plant for the Murray Printing Company, all of Toronto.

Mr. L. E. Dowling

tages but not the third. A more original plan was based on the reasoning that if the water in the wet batch could be prevented from escaping by absorption into the subgrade and by surface evaporation, the need of a water-supply on the grade would be eliminated. It was considered that this conservation of water might be effected by oiling the subgrade and by covering the concrete, immediately after finishing, with a thin skin of asphaltic material. Other considerations were the use of lighter trucks and the use of pneumatic tires.

The mixer experience of the year demonstrated that: (1) For high-speed road construction, mixers of greater strength and endurance in details are essential; (2) a number of mixers are incapable of handling dry mixtures speedily. Without much doubt, the use of dry mixtures will be extended. Whether they will prevail elsewhere than on paper is an open question. Observations of many operations under dry-mixture specifications last year led one to wonder how much of the concrete which went into pavement slab came strictly within the requirements of a 2-in. maximum lump. In the circumstances, then, it may not matter whether great effort is made to improve mixers for handling dry concrete, but the improvement of their strength and endurance is essential.

Machine finishing of concrete slabs was a success wherever employed. It produced a well-compacted concrete and a smooth, even surface. As a labor saver it demonstrated its right to a prominent place among road-making machines, whether dry mixtures or wet mixtures be used. A sturdy side form is necessary, and the year's experience indicated that side forms need to be heavier to remain firm under the vibrating travel of the finisher and not to develop a permanent set. An observation which merits attention is the action of the machine in flushing to the surface an appreciable depth of mortar above the stone. This is an advantage, or the contrary, as one approves a mortar surface or holds that tough stone, flush with the surface, is essential to resist wear.

Heavier Standards Required

Greater ability to endure continuous hard service is, in general, a requirement of highway-construction equipment. There are individual machines which do not need strengthening, but, in general, weight and strength must be added. The nature of certain operations is such that responsibility rests on a single unit and so, when that unit fails, work stops. Duplication of such units is expensive, but that is not the most disadvantageous feature, in road work, of this ordinarily successful insurance of continuous production. If a mixer has a minor-part breakdown, for example, the time required to move a duplicate machine several miles into the field is seldom less than would be required to repair the break. Duplication of plant is scarcely practicable except in the sense of providing spare machines and parts; and, therefore, road machinery needs to be exceptionally well guaranteed against accident by strong construction. A master mechanic and a repair gang and ample spare parts are further insurance required on every heavily outfitted road-construction operation.

Heavily machine-equipped operations characterized the year's highway-construction methods. Under the conditions prevailing, the year's record of performance did not establish the superiority of large-plant methods. Management becomes a greater factor of success in large-plant operations, and heavier equipment in general is required to guarantee the intensive service which is its fundamental idea. Continuous output requires factory methods in maintaining raw-material supply, in routing operations, and in keeping equipment in working condition. These are the broad acquisitions, from last year's experience, to the knowledge of road-construction plant with which contractors undertake the new year's work.

Sewage Problem of York Township, Ont.

(Continued from page 203)

subdivision of land in the future and so regulate building operations that houses are built in more or less compact districts ever growing from their margins instead of our present system, which leaves the sewerage engineer with the problem of connecting up groups of houses separated by stretches of undeveloped land. Another point is that subdivisions might sometimes be laid out on the natural contours of the ground and a break-away made from the rectangular system of street planning when the latter involves absurd street grades and arbitrary interference with watersheds. Subdivisions should also be so arranged that accommodation for sewers and transportation might be provided on the most suitable lines.

This is a brief description of some of the work done in framing a sewerage scheme for a large area. I have not touched on the disposal of sewage as that is a problem in itself. In conclusion I would like to give credit to Mr. Wynne-Roberts, the initiative for much of the work here described being his.

Publicity for the Contractor

A new idea in publicity for construction work has been instituted in the building of an extension for Selfridge's, the large American department store in London. A gangway is laid across one end of the excavation and the public is invited to pass over and view the foundation work. To assist the non-technical man in comprehending what he sees, all the machinery is labelled conspicuously: "concrete mixer," "crane," etc. This is in decided contrast to the more usual practice of putting up a tight fence and leaving a more or less curious public to peep through occasional and unsatisfactory knot holes. The publicity idea has elements of value to the contractor and—in this case—to the owner also, who instituted it to advertise his store and its activities.

Trade Incorporations

Border Housing Company, Limited, with head office at Walkerville, Ont., capital $500,000.

Canadian Reclaimers, Limited, with head office at Toronto, capital $50,000, to manufacture machinery, construction tools, etc.

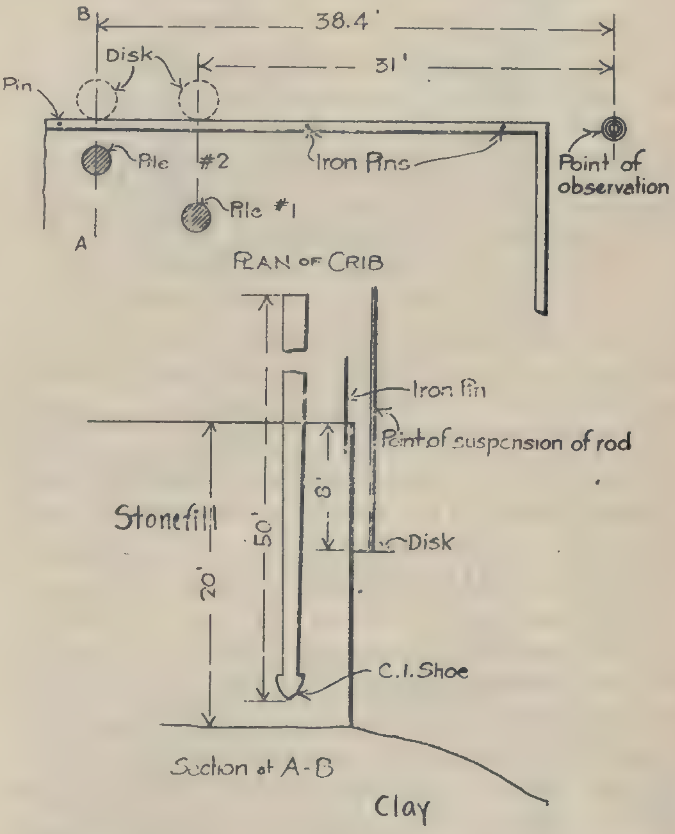
Banigan, Armstrong & Thompson, Limited, with head office at Toronto, capital $40,000, to carry on the business of architects and engineers.

Pearson, Burleigh, Limited, with head office at Winnipeg, capital $20,000, to carry on the business of general contractors and builders.

Method of Checking Movement of Crib Through Which Piles are Driven

By A. Langlois, B.A.Sc., C.E.*

The sketch herewith illustrates the method employed to check the movement of the faces of a timber crib during the driving of two test piles, 50 ft. long, driven through 20 ft. of the stone of the crib. The object of the experiment was to determine just what movement takes place when piles are driven through the crib ballast. The test was made by Mr. S. J. Chapleau, District Engineer, Department of Public Works, the writer having charge of the instruments. In carrying out the experiment, a trestle or stand was erected on which was attached a pole supporting a disc and the transit. The method of making the observations is evident from the sketch. Two 50-ft. piles were driven for their full length, 20 ft. through the stone of the crib work and the balance through clay. The piles were shod with cast iron shoes and banded at the butt with an iron ring. A 200-lb. hammer was used for driving. The result of the experiment was most satisfactory, one pile being driven as close as 12 in. from the face of the pier, with a slight move of hardly ¼ in. recorded on the top two timbers. During the driving of pile No. 1 not the slightest move was detected.



Piles driven through stone filling of crib produce negligible movement

Co-operation of industrial and technical associations as an effective means for promoting the interests of an industry was brought out in a report presented at the annual meeting of the National Association of Sand and Gravel Producers, held in Chicago on February 11 to 13.

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*Chief assistant engineer, Department of Public Works, Ottawa.

Squamish Hydro-electric Power and Water Supply Development

History of Project and Construction Details by J. B. Holdcroft, A. M. E. I. C., Designing Engineer and Engineer in Charge

The town of Squamish, B.C., while at present little more than a village in population, is the southern terminal of the Pacific Great Eastern Railway, and the site of the company's repair shops. The town is very pleasantly situated at the head of Howe Sound, and gives a promise of becoming, if not a large city, at any rate a very prosperous industrial town as the various local natural resources are opened up. The southern end of the railway, of which Squamish is the logical outlet to salt water, is very richly endowed by nature, and should develop along agricultural lines to a large extent, as well as profit tremendously from the almost illimitable supplies of timber available close at hand, while the mineral possibilities have hardly been exploited or even explored, as yet, but are known to be very great.

The town is, very naturally, the home of a great number of the railway employees, and it was this fact, coupled with the necessity of finding an economical source of power for the repair shops, that in 1913 induced the then directors of the company to commence the development of a hydro-electric power plant to produce 500 horse-power from the waters of Monmouth Creek, a stream three miles west of Squamish and across the Squamish River. Plans were completed, the machinery and pipe for the penstock were purchased and delivered on the site of the work, and construction was on the point of commencing, when orders were suddenly issued by the directors of the company to discontinue the work indefinitely.

The supply of water for domestic purposes in the town was not contemplated under this project, for the reason that the Newport Water Company had obtained a license to divert and use for domestic purposes three second feet of water from the Stawamus River, a stream east of the town, undertaking to install suitable head works, a pipe-line and distributing system to give a good supply of water to the town. This company laid a distribution system of sorts, but had installed temporary headworks on a small stream, a branch of the main Stawamus River, pumping a more or less inadequate supply from this point to a 5,000 gallon tank situated on top of a saddle-back about 175 feet above the town. This supply was most unsatisfactory, and gave a lot of trouble. owing to the engine or pump breaking down frequently at awkward times, but the company never made any move to complete the original project, probably on account of financial difficulties. Later on, during the business depression immediately preceding and during the war, the water company gave up even trying to operate the system as it stood, and put it up to the residents to run the system themselves as best they could, charging them only a nominal rental.

This situation resulted in many public meetings and much heart-burning, but after several plans had been tried ont and found impracticable for various reasons, Mr. Wallace Kennedy, a well-known resident of Squamish, agreed to take over and operate the plant as it stood, undertaking to pay the rentals and reimburse himself out of water rates which were then agree upon. The duties thus taken over proved onerous beyond all expectations, with the profits not by any means commensurate with the trouble involved, and much credit is due to Mr. Kennedy for the public spirit displayed in sticking to the work through increasing difficulties until the gravity supply was at last available.

Even under this arrangement, however, the supply was necessarily so uncertain and spasmodic that as soon as the Provincial Government had taken over the management of the Pacific Great Eastern Railway system, the residents of the town started a campaign to have the government either force the water company to complete their project, or itself, through the railway company, install the system. These representations finally resulted in the purchase, by the railway company, of all the property of the water company for the cost of actual construction, without any allowances for repairs or interest, while "good-will" was naturally non-existent under the circumstances.

Surveys and investigations were immediately undertaken to determine on the best method of utilizing and improving the property thus acquired, and it was finally decided to apply for the record of additional water on the Stawamus River, and make the plant a combined water-supply and power plant, utilizing the machinery which had been purchased several years before for the development at Monmouth Creek. Thus would be gained the advantage of a self-contained plant which would give an adequate supply of gravity water for the town and the use of the railroad shops, while electric current could be generated to the extent of a maximum of about 270 horse-power within a reasonable limit of expenditure. This plan contemplated using all of the pipe and machinery purchased for the original Monmouth Creek plan with the exception, of course, of the water-wheel itself, which would have to be changed to meet the new hydraulic conditions.

Designs were now drawn up on these lines. The selection of all equipment was done with an eye, as far as possible, to keeping the expenditure within the Province, as well as keeping it as low as possible. With this in view the dam was to be constructed of crib-work from timber cut near the site, and the main portion of the pipe-line of wood stave pipe manufactured in Vancouver.

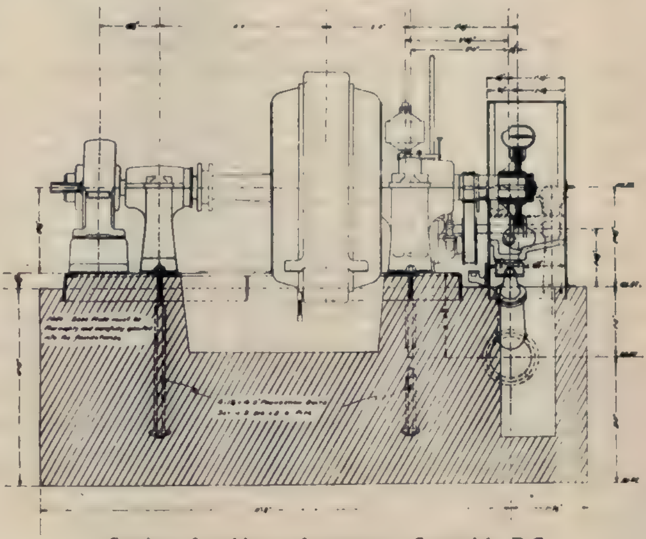
Three second feet of water were already recorded by the Newport Water Company for domestic purposes, and the conditional license for their works became the property of the Railway Company with their other assets. Seven second feet more, for power purposes, were applied for, and as the working head for the sizes of pipe chosen was calculated to be 350 feet, the horse-power available would be about 223. It wsa considered probable, however, that for a considerable time to come the entire quantity of water reserved for domestic purposes would not be required, and that one second foot would much more than cover the maximum demand. It was therefore decided to arrange the unit so as to be able to use two additional second feet of water for power, with only minor alteration, in which case the delivery of power would be in the neighborhood of 270 h.p., as stated above.

The total length of pipe line is 10,900 feet, and the total head is 420 feet. Storage is not possible, as far as has been ascertained though the stream has not been explored with this in view for a greater distance than 6 miles above the site of the dam. The low water flow was taken as 8 second feet from observations made by Messrs. Cleveland and Cameron, who were consulting engineers for the Newport Water Company when the original waterworks were in progress. During the twelve months in which the present engineers have been engaged on the work no flow as low as this has been noticed, though, owing to the pressure of the work no proper measurements have been taken, and only rough estimating methods have been used in judging of the river's actual flow. The maximum flood or freshet flow was estimated, from a study of such data as were available, to be 4,000 second feet, and spillway room was provided for this flow. This calculation was proved to be substantially correct since the dam has been completed. The structure has successfully withstood two heavy floods, the second of which was accompanied by considerable quantities of broken ice. The spillway proved to be of ample size without being too large, and no damage was done to any part of the structure.

Design

The type of construction chosen for the dam, as stated above, was timber crib, as regards most of its length, including the spillway, but a section of 56 feet is of "log-wall," backed by a slope of heavy boulders laid in concrete. It was sited about 175 feet further up-stream than the site chosen by the Newport Water Company, for the sake of using a small island in the centre of the river as a central buttress for the structure. It was also considered necessary to provide ample spillway room on account of the extreme flood conditions expected, as stated above, which fact also had weight in the selection of the site. The spillway was made 60 feet long and at an elevation of 7 feet below the crest of the main dam. It was calculated that an extreme flood would cause a flow of 4 feet over this spillway, which calculation was proved substantially correct when a very sudden and heavy flood occurred in the latter part of November, 1919. This was the first of the two floods mentioned in the preceding paragraph. The second flood raised the water about 6 feet in the pool above the dam, but though this flood occurred in the night, and was not observed by any of the employees of the plant, it is believed that a jam of ice formed just upsteam of the spillway, thus raising the water, and that the abnormal rise was not due solely to the quantity of water flowing at the time.

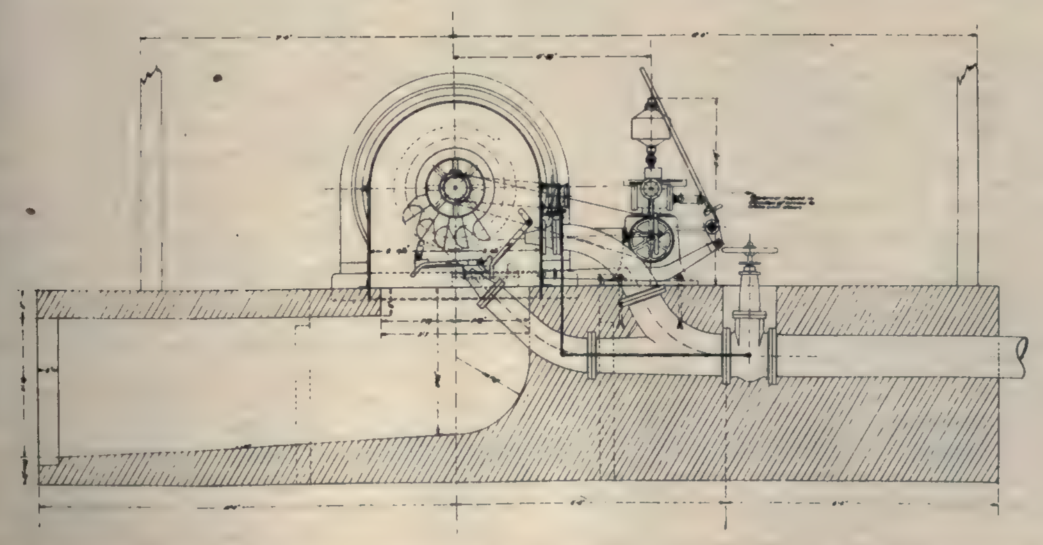
The forebay, which is a simple wooden tank, 8 ft. x 8 ft. x 24 ft., is located about 500 feet down-stream from the dam, and is built on a bench of rock about 30 feet above the river, so that it is absolutely safe from any conditions of flood that may arise. Connection from the dam to forebay is made with 20 in. wood stave pipe, laid with a total difference of elevation between the two ends of 6 inches. The working head, however, is three feet or over, as the overflow of the forebay is set three feet lower than the crest of the spillway at the dam.



Section of turbine and generator, Squamish, B.C.

The flow is controlled by a 20 in. gate-valve set at the up-stream end of the forebay, while the intake chamber at the dam is also provided with a square wooden gate operated by a hand-wheel and screw and the pipe-line is protected from the entrance of large pieces of foreign matter by a wooden rack screen set over the end of the pipe. At the outlet of the forebay another screen is provided, cylindrical in shape, built up of light angle iron sections and covered with wire cloth with one-half inch meshes. Troble was experienced during flood periods with leaves and other debris getting through the rack screen and accumulating on the wire screen in the forebay. This occurred to such an extent that the wire screen eventually partially collapsed, and a repetition of the occurrence will be prevented by installing additional flat wire screens which can be easily raised for cleaning without exposing the end of the pipe.

From this point on to the tanks which were installed

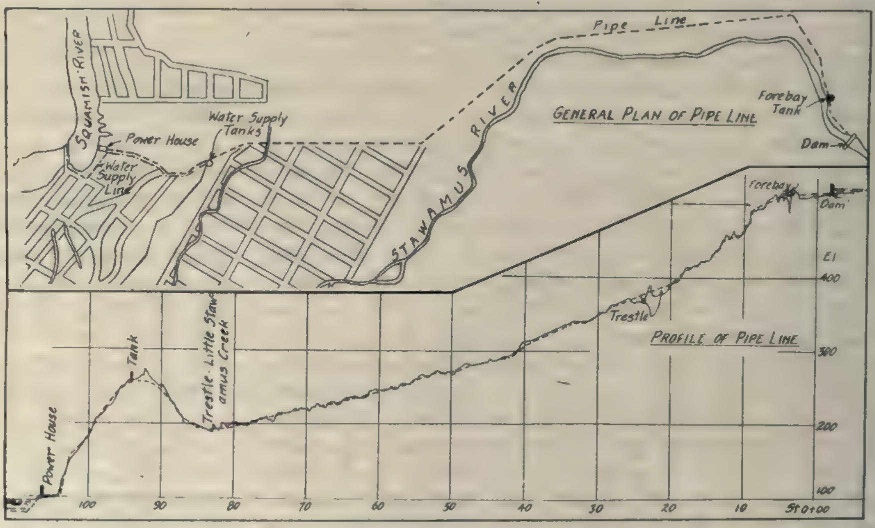


Section showing penstock, governor, waterwheel and discharge arrangement, Squamish Hydro-electric plant.

as distributing reservoirs for the domestic and fire protection supply, the water is carried in wood stave pipe of the factory-made type, the sizes varying from 20 in. at the forebay to 16 in. at the tanks, the size varying by 2 in. at each change. Joints were made by means of wood stave sleeves fitted with from 2 to 5 round iron hoops of the type used for continuous stave pipe, according to the pressure at each particular location. The highest static head on any portion of the wood stave pipe is 320 feet. At the tanks, as above noted, the construction changes to steel pipe, using the pipe which was manufactured for the Monmouth Creek project which was 14 in. in diameter, partly fitted with hub and spigot joints and in the lower section, with bolted flange joints. Practically no trouble has been experienced with the pipe. No serious leaks have developed, with the exception of a blow-out which occurred at a bend. In this case the ground had become very much softened by long continued rain and, the weight of the concrete anchor alone proved insufficient to hold the work together. This was repaired in a few hours, however, and service resumed with scarcely any interruption.

The power house is a simple frame structure, 20 ft. x 24 ft., but well built, as is of course necessary for housing the electrical machinery. It was found necessary to drive piles to support both the building and machinery, as it is located on the bank of the river on a silt and sand deposit and it was feared that the vibration would cause trouble.

The generator is a Canadian General Electric 3 phase, 60 cycle, alternating current dynamo, designed for 400 kilowatt output at 4,200 volts. The water-weel is direct connected (single overhung), and is governed by a Pelton type oil pressure governing machine. The hydraulic conditions being entirely different from the original scheme, it was necessary to change the water-wheel runner. Offers were received from the Pelton Company and from the McKinnon Waterwheel and Power Company for making the changes; the latter being a British Columbia concern as well as showing a considerable advantage in price over the Pelton offer, the work was handed to the local firm. This may be said to be the first special wheel of this or any type to be manufactured in the province and it has proved most satisfactory during the trials, only a few minor alterations and adjustments requiring to be made. The designs and detail drawings for this wheel, with its governing mechanism (of the deflecting type) were made by the writer.



Plan and profile of water pipe system, Squamish hydro-electric and water supply system. Total head 420 feet; length of pipe 10,900 ft.

The penstock anchorage, generator foundation and the first section of the tailrace are made monolithic in concrete, a small amount of reinforcing steel being used. On leaving the power house, the tail-race construction changes to a simple timber flume to the river bank, a distance of about 70 feet. This part of the structure is reinforced by timber brackets with outside bracing, and is weighted down with stones and earth, a precaution made necessary by the fact that at high tides, when the river is in flood, the water rises almost to the wall of the power house, and would otherwise lift the flume out of its place—which actually happened once during construction.

The high tension distribution system consists of No. 6 hard drawn copper wire, and leaves the power house in two three-phase circuits arranged in equilateral triangles. One circuit branches off at the railway crossing and follows the track to the railway shops, where a pole substation is located, consisting for the present of two 30 kw. transformers from 4000 to 220 volts for the motors and one 5 kw. transformer from 4000 to 110 volts for the lighting system.

The other circuit goes on into the town and supplies current for the street lighting system, as well as for private consumers and lighting the company's office and dock. Two 5 kw. transformers and two of 3 kw. are provided for this purpose, and another of 3 kw. capacity is installed at the end of the railway dock to care for the lighting needs there. It is expected that another of 10 kw. capacity will be required at this point before long to supply power for operating a new transfer slip which is proposed to be erected there. All wires with the exception of telephone wires are covered with w.p. braid insulation inside the town limits. Secondary mains are of No. 2 soft-drawn copper wire.

A telephone system has been installed in connection with the power house, with instruments at the railway offices in town, at the shops, and at the power house itself. All practicable precautions have been taken to prevent injury to the system or to persons from contact high tension wires. Lightning arrestors have been provided on both power and telephone circuits, and emergency cut-outs are installed on each power wire leaving the generating station.

The largest single item included in the improvements to the water system taken separately, was the laying of an 8 in. main to the railway shops for fire protection and general water-supply purposes. The headworks were much improved also. The temporary system installed by the Newport Water Company included a 5,000 gallon wooden tank, intended as a balancing reservoir. The pumped supply described above, however, was so meagre that water was only available intermittently, and sometimes failed altogether for hours at a time.

A tank of 25,000 gallons' capacity was, therefore, added to the existing tank, while the latter was raised to bring its water surface to the same height as the larger one. Supply was then arranged for from the power penstock, a 6 in. riser being put in from the main to each tank, controlled in the first instance by gate valves, and at the tanks, for normal operating conditions, by automatic float valves. The two tanks were then so connected on the discharge side that either tank could be retained in service while the other was being emptied for cleaning or repairs, although under normal conditions the two tanks are operated as a unit. This arrangement has been found to meet all requirements very satisfactorily, and no complaints of shortage of water have been received since the completion of the work. It was found absolutely necessary, however, to provide some kind of a supply from the earliest possible moment during the construction period as the pumped supply was on the point of giving out altogether, owing to the iminence of a complete breakdown of the pump and engine. A temporary connection was made therefore as soon as the penstock reached the point where the new tank was to be located. The end of the pipe was temporarily plugged, and an ordinary hose connection (2-1/2 in.) was inserted with a short length of hose attached which was led into the disconnected end of the old 10 in. water supply main to the town. This service was maintained thereafter, with scarcely a break until the tanks were properly connected up and ready to put into regular service.

All the formalities incident to obtaining the water licenses were also carried out and completed during the progress of the work, while tentative plans were also made for the organization of the operating system. The plant commenced its existence as an operating public utility on December 15th, 1919, with a list of about 80 subscribers for water and about 25 connections made for electric light service, in addition to the power and water connections at the railroad shops. These connections are being added to at the present time as fast as the work can be done, and it is estimated that the present business will more than take care of the operating expenses, while if the entire output can be disposed of at power rates the revenue will not only pay all financial charges, but provide a very satisfactory dividend as well. This is the more satisfactory as the plant was not designed primarily with a view to profit-making, and would have been satisfactory if it would only be barely self-supporting as regards revenue on account of the indirect advantages accruing which can hardly be estimated in terms of money.

Statement of Capital Expenditure

Construction & equipment of buildings, fixtures & grounds	$ 2,706.61	
Hydraulic Power Works	68,314.86	
Hydraulic Power Plant	1,606.20	
Distribution System (Electric)	11,114.40	
Waterworks System	20,380.07	
General Expenses	9,125.41	
January payments (not distributed)	15,349.96	$128,597.51
Accounts outstanding, Jan. 21, 1920		
Robertson & Partners	3,375.10	
McKinnon Water Wheel & Power Company	623.85	
Vancouver Engineering Works	26.15	4,025.10
Total cost of Development		$132,622.61
Plus increased Capitalization to supply a town of 300 houses.		
Electric Distribution, estimated	3,000.00	
Water Distribution, estimated	5,000.00	8,000.00
		$140,622.61

Statement of Fixed and Operating Charges (Estimated)

Fixed Chaages		
Twenty year life.		
Total cost of plant as at date, Jan. 21st, 1920, $132,622.61.		
Interest on capital of $140,000.00 at 5½%	$ 7,709.00	
Sinking fund on capital of $140,000.00 (20 years) at 6%	3,805.20	
Replacement or renewal fund.		
Note—it is not considered advisable to include a fund for entire renewal at end of life, or for perpetual maintenance, as it is assumed that the development in its present form will become obsolete at the end of assumed life of 20 years.		
Maintenance and repairs, 1% per annum	1,400.00	$ 12,905.20
Operating Charges		
Salaries and wages, estimated	12,240.00	
Supplies	600.00	
Taxes		
Water License	113.50	12,953.50
Total estimated yearly charges		$ 25,858.70

Statement of Annual Revenue (Estimated)

Electric		
Connected Load, Jan. 21st, 1920		
38 house and store services at estimated average $3.00	$ 1,368.00	
Railway Co. shops, station, wharf, etc., 5 kw. lighting load, estimated	1,530.00	
Railway Co. power load, 45 kw.	7,974.00	$ 10,872.00
Rest. 130 kw. at power rate (2c) figured on 10 hour load.	9,442.50	
Plus nominal overload capacity for power 50%	4,721.25	
Plus power available for lighting at night, say 200 houses at $2.00 monthly (unsaleable at present)	4,800.00	18,963.75
		$29,835.75
Water		
Connected		
Estimated, 80 house connections at average of $1.25 monthly	1,200.00	
Railway shops at $200.00 monthly	2,400.00	
Two industries at average of $50.00 monthly	1,200.00	4,800.00
Future		
Estimated 200 houses at $1.25 monthly	3,000.00	
Estimated 5 industries at average of $50.00	3,000.00	
(Unsaleable at present)		6,000 00
Grand Total of estimated possible revenue		$ 40,635.75

Personnel

Owners—Pacific Great Eastern Railway.

Chief Engineer—A. F. Proctor.

Engineer in Charge—J. B. Holdcroft.

Resident Engineer—G. T. Livingstone.

General Contractors—Robertson and Partners.

Sub Contractors—C. H. E. Williams, electrical installation.; Gordon and Walker, consrtuction of dam and clearing; Cox and Verge, pipe laying and excavation; Pacific Coast Pipe Co., supply of wood stave pipe.

Mainly Constructional

East and West—From Coast to Coast

Building permits issued in Quebec city during last month showed an aggregate value of $110,650, compared with $20,095 for the month of January, 1919.

The Hepworth Silica Pressed Brick Company, of Hepworth, Ont., have commenced to refit their plant in preparation for the coming building season, when a large demand for the product is anticipated.

The Housing Commission at Niagara Falls, Ont., have applied for a further loan of $500,000 to carry on housing work in the city during the coming building season. A total of 78 houses have been erected to date, under the housing scheme, at Niagara Falls, at an expenditure of $225,000.

It is rumored that the Semet-Solvay Company, of Syracuse, New York, have purchased a site in the Ashbridges Bay district, Toronto, for the establishment of a large by-product coke oven plant. This company has nineteen plants in operation on the other side and owns and controls its own mines in Pennsylvania.

The Housing Commission of Woodstock, Ont., anticipates a busy season in house building. The Commission has $82,000 of last year's grant available, so that there will be no delay in getting operations under way just as soon as weather permits. It is expected a further grant will be asked for this year.

The erection of a four-building hospital, at Windsor, Ont., comprising a 300-bed hospital for general purposes, a 50-bed hospital for isolation cases, nurses' quarters and a power plant, to serve the interests of the border cities, is now being considered by the Joint Board of Health and Essex Border Utilities Commission. The estimated cost of the proposed building is $1,000,000.

The Alberta Association of Architects has petitioned the Board of Commerce to take immediate action to prevent, or at least curtail, the export of lumber to the United States until such time as the demands of the Canadian consumers have been satisfied. The Architects further ask that steps be taken to regulate the price of lumber.

Figures issued recently from the City Architect's office, Toronto, show that 3,066 dwelling houses were erected in the city during last year, as against 792 for the year 1918. Of the 1919 total, 2,692 houses were of brick construction, with a total value of $8,385,280; brick front and rough-cast dwellings numbered 303, with a value of $623,210, and frame dwellings, 71 for a total value of $123;100.

The annual meeting of the General Contractors' and Master Builders' Association was held recently in the Pacific building, Vancouver. Following are the names of officers elected for 1920: President, F. T. King (re-elected); first vice-president, J. C. Dill; second vice-president, J. Tucker; honorary treasurer, George Murray; secretary, James Hart; executive, E. G. Baynes, W. J. Prout, H. A. Wyles, S. J. Hewitt, E. C. Chrystal.

Preliminary work on the construction of a canal and the rebuilding of the dam at Bobcaygeon, Ont., is under way. The surveyors are at present on the job and arrangements have been made for the building of shacks to accommodate 200 laborers. The re-building of the dam will be gone ahead with first and it is expected this will be completed towards the end of the summer. The construction of the canal will probably be started in the fall. This latter project will require about two years to complete.

Mr. R. L. Dobbin, Superintendent of the Waterworks Department, Peterboro, addressed a recent meeting of the Board of Trade of that city, on the subject of "Water Filtration." The address was illustrated with several interesting slides of various types of filtration plants in use in foreign countries. Several members of the local branch of the Engineering Institute were present at the meeting.

The Dominion Government is now calling tenders for the construction of the lignite briquetting plant to be located at Hudson Bay mine, in the Bienfait district, Sask. This is but the first step in the development of the lignite industry in Saskatchewan. The initial plant, mentioned above, will include: Office and laboratory, 29 by 50 ft., brick veneer car house, 16 by 44 ft., frame; crusher building, 15 by 20 ft.; two raw lignite bins, 40 feet high by 25 feet in diameter, reinforced concrete; drier building, 84 by 40 ft., structural steel and brick curtain wall; carbonizer building, 84 by 55 ft., brick curtain wall; briquetting building, 55 by 42 ft., brick curtain wall; briquette bin, 80 by 16 ft., frame; power house, 100 by 48 ft., brick bearing walls and wood roof; coal shed, 15 by 42 ft., reinforced concrete; coal shed, 15 by 60 ft., frame. This plant will cost in the neighborhood of $400,000.

Personal

Mr. Henri Ortiz, assistant engineer in charge of the Road Department of the City of Montreal, has been appointed manager of the Town of Grand'Mere, P. Q.

Mr. L. L. Theriault, C. E., has been appointed town manager of Edmundston, N. B. Mr. Theriault was previously engaged as road engineer in the Public Works Department of New Brunswick.

Four appointments to the staff of the City Architect's Department, Toronto, have been approved by the Board of Control: Messrs. James H. Lowry and John M. Scott as draftsmen, and Wm. B. Redman, B.A. Sc., and Thos. S. Graham, BA. Sc., to the engineering division.

Capt. Charles P. Disney has been appointed Bridge Engineer of Eastern lines of the Canadian National Railway, with headquarters at Toronto. Capt. Disney, previous to his departure for France in 1915, had been engaged in bridge construction with the Intercolonial Railway, the National Transcontinental Railway and the Dominion Bridge Company.

Mr. F. M. Clarke, formerly of the Barrett Company, has received an appointment to the position of assistant to Chief Engineer Roland of the Nova Scotia Highways Commission. Mr. Clarke has had extensive road building experience both in Canada and the United States, one of his latest undertakings being the Tarvia road between St. John and Rothesay, N. B.

Trade Incorporations

Archambault-Leclair, Limited, with head office at Montreal, capital $100,000, to carry on the business of building contractors.

Bonnycastle Buildings, Limited, with head office at Toronto, capital $40,000, to carry on the business of general contractors and builders.

Jno. Maguire Contracting Co., Limited, head office at Toronto, capital $40,000, to carry on the business of general contracting in all its branches.

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"Good Roads Week" in Ontario Develops Movement for Better Highways

"GOOD Roads Week" is the term by which last week, March 1 to 6, might well be called, so far as Ontario is concerned. During five days of that week two conventions were assembled to discuss the highway policy of the province and to present for consideration the problems and difficulties confronting the builders and advocates of better roads. It is safe to say that such great enthusiasm as was evident this year was never before displayed at any previous meetings of the associations which met last week. The attendance at both conferences was vastly greater than was anticipated and exceeded the capacity of the halls provided for the meetings. But not only was the attendance in excess of previous records but the enthusiasm among the delegates was at a higher pitch. Discussions were lively and profitable; interest was sustained and widespread and the calibre of the papers and addresses was of a particularly high order.

* * *

In their particular fields, the conference on Road Construction for County Road Superintendents and Engineers and the Ontario Good Roads Association are each unique. The former, which meets annually under the auspices of the Ontario Department of Public Highways is a body whose aim is largely educational. It comprises the various county road superintendents and engineers of Ontario who meet in conjunction with the staff of the Highways Department for co-operative enlightenment and education. The principal object is to get these practical superintendents together to have what amounts to a heart-to-heart talk. They are enabled to exchange ideas, to discuss their difficulties, to offer suggestions and to generally improve their knowledge of road building. The problems that confront these men on their daily rounds of duty are aired and remedies suggested. Light is shed on little vexing technicalities of legislation as they affect county superintendents and means are suggested for overcoming the perverseness of county and township councils often so detrimental to the progress and well-being of road programs. These and a dozen other things come before the county superintendents and engineers at this annual conference held by the Ontario Highways Departments.

* * *

It is apparent that it is really a get-together family gathering under the paternal guidance of the departmental staff. On their part, this staff has much to do and much to gain. They meet the superintendents, get acquainted with their ideas and methods and are enabled thus to co-operate to the best possible advantage with the men who, in reality, carry on their shoulders the burden of responsibility for a good road system throughout the province. The department engineers arrange a program of papers, prepared on as practical a basis as possible and urge all the superintendents to join in the discussion. In fact the discussion feature is emphasized and brevity in the papers or addresses themselves is urged so that there will be time to have the opinions and experiences of the practical road builders exchanged.

What has been the result of such a conference? One needs to travel the counties and townships to see the real lasting effects of this policy of the Ontario Department of Highways. The real results are evident in the handiwork of the superintendents—in the better roads they put down and in the improved and more conscientious methods they try to adopt. Each superintendent, after attending this three-day conference in Toronto, goes back to his county animated by a spirit of co-operation, not only with the provincial highway department, but with his brother superintendents of other counties. He knows that his tribulations are not his alone, but have been met and overcome by his confreres elsewhere; he learns that the physical disadvantages of his county need not defeat the construction of improved highways any more than they do in other counties; he recognizes that his county being an integral part of the whole province, demands a course of action that will elevate its standard of construction and thereby keep up the standard of the province as a unit.

The Ontario Department of Highways did not go far astray in determining upon a policy of holding an annual conference of the nature described. The one which took place last week on March 1, 2 and 3, was the sixth. With each succeeding one there has been a growth of interest and last week's showed conclusively that the good roads movement had taken firm root and was exerting a powerful influence. On paper it is impossible to record enthusiasm, but it must suffice to state that the interest displayed at that meeting was a sure indication that in the very near future Ontario will have a road system giving first place to none on the continent.

* * *

No less enthusiasm was evident at the eighteenth annual meeting of the Ontario Good Roads Association, which met on March 3, 4 and 5 in Toronto. The Association had a somewhat broader raison d'etre than the conference referred to above, The object of the Ontario Good Roads Association is more propagandic and legislative. Organized in 1894 it has consistently and persistently advocated the building of improved highways. The prime reason for its existence, indeed, has been to secure throughout the province of Ontario a system of highways that will meet its transportation requirements.

Further than that, however, the Association has been advising on legislation. Enjoying the recognition of the Ontario Government, it has been enabled to offer wise suggestions regarding legislative action. On the statute books to-day there are many highway laws and amendments that have been based on stands taken initially by members of the Ontario Good Roads Association. One of the chief features, indeed, of their annual meetings is the submission and consideration of questions and resolutions on legal points.

* * *

This year added interest accrued to the meetings held last week by virtue of the change of government. The policy of this new legislature so far as roads were concerned, was, therefore, awaited with keen expectancy. With greater elaboration than heretofore, the new policy was explained at both conventions by Hon. Mr. Biggs, Minister of Public Works and Highways for Ontario, and won instant and unanimous approval. The details of it are dealt with at some length elsewhere in this issue. Suffice it to say that it is a policy that is both progressive and far seeing.

The Contract Record has, through its editors, kept in close touch with the proceedings of both the conference on Road Construction of the County Road Superintendents and Engineers and the meeting of the Ontario Good Roads Association. The proceedings are published in the following pages which record the activities of the two most enthusiastic gatherings in Ontario in the interest of roads.

Committee on Waters and Water Powers Presents Report

IN addition to the kind of motive power with which it is more directly concerned, namely, water-power, the Committee on Waters and Water-Powers is also interested in others such as steam, gas, oil, etc., for the purposes of comparison with water-power in such matters as cost, desirability and possibilities. With this in view and further prompted by the close connection which water-power has with electricity, this Committee began an investigation on the production of electrical energy throughout the Dominion whether derived from water-power, steam, or other modes of primary power, this resulting in our report on "Electrical Generation and Distribution in Canada".

This report, which was published and distributed during the year, has been well received and seems to fill a long-felt want, being the first publication to cover the subject for Canada in a complete and detailed manner. In view of the important place taken by hydro-electric energy in the various expansions of the country, it seems desirable to have adequate data both as to the supply, distribution, demand and rates in connection with electrical energy in the various communities of the Dominion.

The intimate relationship between electrical energy and water-power is now a well established fact and the above mentioned report demonstrates that this is particularly applicable in Canada; of the total central electric station capacity, over 85 per cent is installed in water-power plants and less than 14 per cent in steam plants. Nor do these figures sufficiently accentuate the predominance of hydro-electric energy in the actual supply of the country's needs as a large number of steam plants are only installed for auxiliary or emergency purposes and some years may not be used at all. It is of interest to note the large size of our hydro-electric plants; 41 per cent of the total installation is in plants of 100,000 h.p. or over while another 43 per cent is in plants of between 10,000 h.p. and 100,000 h.p. leaving only 16 per cent in plants of under 10,000 h.p. capacity.

Rapid Strides in Hydro-electric Development

The rapid strides previously recorded in this connection are attaining even greater proportions, this being fully demonstrated by recent progress in hydro-electric installations actually completed and placed in operation, as well as in the developments at present in construction and others definitely contemplated for the near future. During the past year the installation of a total of 64,400 h.p. was completed in various portions of the Dominion; the various developments at present under construction or in process of installation aggregate over 370,000 h.p., while other projects

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Canada's Engineers—Geo. Hogarth

If we were to pick out two men responsible for the success of the Conference on Road Construction, the sixth annual meeting of which is recorded in this issue, we should name Mr. W. A. McLean, Deputy Minister of Highways for Ontario, and Mr. George Hogarth, Chief Engineer of the Highways Department, whose sketch is appearing herewith.

Mr. Hogarth is a road engineer through and through, having been connected with the Department of Public Works in Toronto since his graduation in engineering. Mr. Hogarth is a native of Toronto and attended the public and high schools in that city. He graduated from the Faculty of Applied Science, University of Toronto, in 1909. From 1905 to 1907 he was engaged on railway work with the Canadian Northern Railway and the Grand Trunk. With the Grand Trunk Railway he served as instrument man on track work; on surveys and general railway maintenance work, on the construction of sidings, coal trestles, double tracking and grading. From 1910 to 1916 he was assistant engineer of the Ontario Department of Public Works, engaged on the construction and maintenance of bridges, locks, dams, drainage work, waterworks and other departmental engineering work. Some of the biggest undertakings were: Magnetawan Lock on Magnetawan River; Kaministikwia River Bridge; Winnipeg River Bridge, Spanish River Bridge and the Sturgeon Falls Bridge. At the present time Mr. Hogarth is chief engineer of the Department of Highways, in charge of the construction and maintenance of provincial highways. One of the large projects now being carried out under his supervision is the Rouge River bridge near Toronto, of 650 ft. span. Mr. Hogarth is an Ontario Land Surveyor and member of the Engineering Institute of Canada.

Mr. Geo. Hogarth

and expansions definitely contemplated for the near future will add some 750,000 h.p.

The salient feature in this present expansion is the stupendous undertaking in connection with the Ontario Hydro-Electric Power Commission's development at Niagara Falls, the construction of this being at present about one-half completed. While the initial installation for this Chippawa development is to be around 200,000 h.p., expansions to 500,000 h.p. are contemplated in the not far distant future. In addition to the large amount of power involved the development is also remarkable as being designed to use the greatest possible head available for Niagara power, namely 316 ft. as compared with heads varying from 64 ft. to 180 ft. at the other Niagara plants.

Progressive Policy of Quebec Government

Another item worthy of note in regard to Canada's water-power expansions is the impetus given by the progressive policy of the Quebec Government in facilitating and encouraging conservation water storage. This has been put into actual practice on a number of streams while projects for a number of others are either under construction or definitely contemplated. As a direct result of this a number of plants have been able to increase their output and new plants have been installed. As an instance, it has recently been stated in connection with the Gouin Government reservoir on the St. Maurice river that the capacity of the Shawinigan and Grand'mere plants is soon to be raised from the present 330,000 h.p. to some 600,000 h.p.

(Continued on page 238)

The Asphalt Association

Permanent headquarters for the Asphalt Association, an organization representing the producers and users of Asphalt for paving purposes, have been established in the new national Association Building, 25 West 43rd Street, New York City. From its main headquarters and its branch offices at Washington, Chicago and Toronto, the Asphalt Association will continue its educational and research work, looking to extension and development of asphaltic types of highway construction along the most effective engineering and economic lines.

J. E. Draney, of the United States Asphalt Refining Company, is president of the association; W. W. McFarland of the Warner-Quinlan Company, is vice-president; Herbert Spencer, of the Standard Oil Company of New Jersey, is treasurer, and J. E. Pennybacker, formerly Chief of Management of the United States Bureau of Public Roads, is secretary.

A feature of the association's activities is a brochure series explaining the approved methods of constructing asphalt pavements including asphalt macadam, asphaltic concrete and sheet asphalt pavements and presenting information as to asphalt specifications, the use of asphalt fillers for brick and block pavements. Lectures in universities and colleges have been given, or arranged for, in about twenty-five of the leading educational institutions of the United States and Canada.

The Canadian district offices of this association are located at 95 King Street East, Toronto, Ont.

County Road Superintendents and Engineers Co-operate with Departmental Staff

Sixth Annual Conference Under Auspices of Ontario Department of Highways — Papers Covering Wide Range of Topics are Published Herewith

UNDER the auspices of the Ontario Department of Highways, the sixth annual conference on Road Construction of Road Superintendents and Engineers met on March 1, 2 and 3 at the Parliament Buildings, Toronto. Reference has already been made in our editorial to the record attendance and the interest and enthusiasm displayed by the delegates. The papers read at the conference were comprehensive so far as topics were concerned and were primarily prepared to stimulate discussion and evolve ideas. Some of these papers appear in more or less abstracted form elsewhere in this issue. The discussions which followed their reading was well taken up and produced many worth-while ideas.

Future Road Policy of Ontario

If any one feature of the conference demanded emphasis, it was the address of F. C. Biggs, Minister of Public Works and Highways, in which he described the future policy of his department. The value of maintenance was emphasized and the Minister did some plain speaking in regard to his policy on this point. He stated that the old practice of constructing a good highway, and then practically forgetting it, so far as maintenance is concerned, is going to be stopped, and that the Department of Highways is not going to pay maintenance grants to counties that are not getting results.

Maintenance Insisted Upon

"One point upon which the mind of the Department is made up is this," he said, "that when a Government engineer goes out for a final inspection another year, or any time during the season, and finds a certain mileage that is not being consistently maintained up to a reasonable standard, we distinctly intend to cut your maintenance grant on that road. I make that statement so that you may know exactly where you stand in making your arrangements, in making your report to the county councils, because we intend to do exactly what we say we will."

A new announcement by Hon. Mr. Biggs was that the Government proposed to increase the grant toward township engineers' salaries from 25 per cent. up to 40 per cent.

Roads Through Villages

He further announced that it was the policy of his department to increase the maintenance grant on suburban area roads from 20 per cent. to 40 per cent.

Another important announcement was in reference to the percentage of cost which was to be charged against villages through which the trans-provincial highway passes. "We want to make some changes where the highway passes through the smaller villages," said Mr. Biggs. "We propose to build the Provincial highway right through villages of 1,500 population or less without asking that village to contribute one cent to the expense of building that portion of road. We won't ask them to go to any extra expense."

A brief sketch of the highway laws of Ontario was given by Mr. W. A. McLean, Deputy Minister of Public Works, who outlined the progress of legislation from the time of toll roads to the present. He referred to the interpretation of highway laws and urged the road superintendents to make a thorough study of highway legislation and regulations. "The engineers are out to see that they are properly observed," said Mr. McLean, "and some of the counties may find themselves in the lurch unless they have familiarized themselves with the Highway Act."

In the discussion which followed a number of changes in highway legislation were urged. The conference adjourned at noon on Wednesday, March 3.

Drainage is First Consideration in Road Building

By G. R. Marston*

IN road construction, road maintenance and culvert construction, our first thoughts should be given to drainage. It is the first principle of road building. Many articles have been written in the scientific journals and many papers read before road conventions on drainage, but they have not yet penetrated deep enough into the minds of those in charge of roads or else they have failed to impress this matter on those working on the roads; because if drainage was carried out properly, there would be fewer mudholes in earth, sand-clay, gravel and water-bound macadam roads and less foundation failure in the bituminous macadam, asphaltic-concrete and brick roads and less cracks in concrete roads. While there are road failures from other causes, poor drainage is the first cause. Water is the greatest natural enemy of all roads.

There is no set rule for draining a road. Each portion of the road will present its difficulties and the road engineer's business is to overcome the difficulties and to devise the proper system to drain the road. The nature of the subsoil, the topographical features of the road itself and those of the surrounding country will be his chief guides.

Three Types of Drainage

Three types of drainage for roads present themselves: (1) To keep the water out of them; (2) To keep the water from alongside of them; (3) To keep the water from under them. The first two of these propositions are accomplished by what is known as surface drainage, and the third by subdrainage. Surface drainage is always necessary; subdrainage is needed in soils having no natural underdrainage.

The crown of the road, the side ditches or gutters, pipes and culverts, are means which are resorted to to procure surface drainage. The height of the crown of a road necessary to drain an earth road is best obtained by experience. The usual crown is about an inch to the foot of width from the centre of the road to the side ditches and this is usually increased as the longitudinal grade of the road increases. As heavy traffic soon ruts earth roads, it is necessary to use the road drags frequently to prevent the formation of deep ruts or the surface will follow the ruts and the roads will suffer from washouts and erosion.

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* County engineer of Norfolk, Ont.

The side ditch and gutters are intended to carry off the water shed from the road by the crowns and to keep the water from outside of the right of way from flowing into the road. These ditches should be dug to as uniform a grade as possible and should be in good alignment and sufficiently wide to carry off the water and about two feet deep below the outer edge of the graded portion of the road. These ditches will carry the water to the smaller creeks or outlet drains. If there is no apparent outlet, one must be procured either by consent or by the application of the Ditches and Watercourses Act.

It is important that these side ditches and gutters be properly maintained or they may become choked and cause serious damage. When roads are constructed along hill sides, it is often necessary to dig what is known as a secondary drain. This drain should be well up the side of the hill so that it will intercept and dispose of the larger amount of water before it has a chance to reach the regular ditches

Better Surface Drainage from Hard Surfaces

The penetration of the earth, gravel and macadam roads by water has not altogether been solved by crowning of the roads and for this reason many municipalities are constructing roads with more permanent surface, such as bituminous and concrete surface, which prevent the rutting and the consequent action of water. There is no doubt that with increasing traffic, which means more rutted roads, these more permanent surfaces will become more popular, and while more expensive to construct, the decrease in maintenance will offset the increases in cost.

Subdrainage is required where the soil is so dense that the water lies in the ground and can be made dry only by drains placed under the ground deep enough to reach this water. The drains are intended to drain the subsoil only and it is not intended that any surface drainage should be allowed to enter them. Underdrains lower the level of the water in the soil and thereby prevent the road surface from being disturbed by softening of the foundation.

The older types of subdrains such as the wooden box drain and drains built with flat stone have been replaced in the present day by the use of tile. The layout of a subdrainage scheme depends upon the conditions found in the road to be drained. A study of the road should be made and inquiries made from old residents who have known the road for some time. The source and the amount of water should be determined as this information, taken in conjunction with the grade which it is possible to give the tile, will determine the size of the tile required. Tile should, as a rule, be laid on both sides of the road, but this may not always be necessary. Where the roadway is in a cut, having a bank on one or both sides, the water will usually be found to come from these banks in the form of seepage or springs and in these cases a tile should be placed under the side ditch at the foot of the bank which will prevent the water from passing under the roadway. Special attention should be given in grades, as springs frequently occur and sometimes it is an advantage to cross tap a road to prevent water seeping down the hill.

Placing of Tile Side Drains

Care should be taken in laying the tile. The trench should be dug in a straight line. The position of this trench must be determined by the road engineer. I am in favor, in ordinary cases, of placing the tile immediately under the shoulders of the road or slightly nearer the centre of the road than the side ditch. The tile should be laid true to grade. In shifting soil, it may be necessary to lay the tile on inch boards about four or five inches wide. This will ensure them against buckling, which often happens with tile laid in a quick sand bottom. The backfilling of the trench should be made with gravel or stone if possible.

Mr. W. A. McLean, Deputy Minister of Highways, Ontario, has contributed much to the development of a progressive road policy for the province

In bad soils it may be necessary to use a tar paper over the joints to prevent the silt entering the tile. Sawdust has been used very successfully for this purpose. Where the drains have a long run, catch basins should be used. These are used for inspection purposes, and sediment will be trapped here if the bottom of the catch basin be constructed lower than the flow line of the tile. The bottom should be about eighteen inches below the tile. They also provide a vent to the drain. The outlets of all tile drains should be protected with concrete walls where the drains are deep, and by slabs placed over the tile where the tile is shallow.

While a great deal more may be said and written on the subject of drainage, it will be of no avail unless all persons engaged in road work be taught the benefits that a road derives from a good drainage system.

Quarrying and Crushing

By T. V. Anderson*

THE operation of quarrying and crushing constitutes a very important item in the cost of highway construction and I am presenting herewith a few figures and opinions as I see them.

In selecting a quarry, rock containing earthy seams, shelly bedding, and heavy overburden should be avoided. The quarry that makes for greatest output is one with light overburden, rock in regular beds from four to nine inches in depth and an average depth of face of twelve feet.

Cost of Drilling

The first matter to be considered in opening a quarry is the removal of the top earth or overburden, which usually costs from fifty cents to eighty cents per cubic yard. For quarrying rock the steam drill and jackhammer are most commonly used. A good drill runner and his assistant will easily average 75 feet of hole per day of ten hours and the cost will be approximately 16 cents per foot made up as follows:

Wages of drill runner	$ 3.50
Wages of assistant	3.00
Fuel	3.00
Sharpening steels	.75
Rent of engine	2.00
Depreciation of drill	.65
Oil	.25

In quarrying where the rock is comparatively solid the jackhammer is a very useful tool. Owing to its light weight it can be readily moved from place to place by one man and large sections of rock that have been blown out may be quickly drilled and broken into smaller pieces, but where rock is inclined to be shelly the jackhammer is rather difficult to operate, owing to small pieces of stone dropping in the drill hole and clogging the drill.

Crushing Costs

A crusher with a jaw opening of 10 x 20 inches set to 2 inches will easily average 95 cubic yards of crushed stone per day. In operating the crusher it is advisable to employ a man to level the stone in the bin, to see that the teams hauling away the stone are quickly and uniformly loaded and also keep a record of the number of yards and trips each team makes. The daily cost of crushing is about as follows:

Engineer	$ 4.00 per day
Two feeders	7.00
Fuel	5.00
One bin man	3.00
Oil	.50

or approximately 38 to 40 cents per cubic yard.

The following is a summary of the cost per cubic yard of stone ready for the road:

Drilling per cubic yard	33 cents
Explosives	30 "
Quarrying, sledging and loading	42 "
Hauling to crusher	15 "
Crushing	38 "
Supervision	5 "
Contingencies	12 "
Total	$1.75

These prices are for limestone quarries and conditions as they are found in Eastern Ontario.

Location of Holes

In placing the holes they should usually be about three-quarters of the depth of the hole from the face extending about the same distance apart across the quarry. After the holes have been charged they should be fired by use of a battery. An ordinary battery will fire up to thirty holes at once. Much more can be accomplished by firing a series of holes simultaneously than individually.

In lime stone quarries it will require from three-quarters to one pound of explosive of fifty per cent. dynamite per cubic yard of rock. The quantity of explosive to be used depends largely on the depth and length of face of the quarry.

In moving the stone from the quarry to the crusher the common wagon, dump wagon and dump cart are usually employed. Where the haul is short one team will haul to the crusher 45 yards per day. The cost will run about 15 cents per yard. For quarrying, sledging and loading into wagons the cost will average 42 cents per yard.

Crushing

The most commonly used crusher for highway work is portable and of the jaw type and preferably with a jaw opening of not less than 10 x 20 inches, with an elevator of sufficient length to discharge the crushed stone into a revolving screen mounted on a 20 or 30 ton bin with compartments separating the various sizes of stone. When the product of the quarry is principally of uniform size, or what is termed one man stone, the unloading platform or drive way should be of such a height that the bottom of the wagon will be a few inches higher than the crusher opening. With stone of this size two men will have no difficulty in keeping the crusher full. When the product of the quarry is small or principally shovel stuff it is preferable to load it in dump wagons or carts.

A platform with approaches built over the top of the crusher and provided with a trap door, can be used to advantage. The contents of the wagon or cart may be dumped directly over the opening of the crusher. This method saves much time of both teams and men and will save many times its cost of erection.

More Road Work in Haldimand, Ont.

Messrs. MacConnell and Hicklin, contractors, of Toronto and Ottawa, have received a quarter million dollar contract for water-bound macadam roads in Haldimand county, Ont. The contract includes 15 miles of 16 ft. road at $15,000 a mile; 4 miles at $6,500 a mile, and 3½ miles at $8,500 a mile. The first road runs from Cayuga to Dunnville, and the others are in the vicinity of Hagersville and Jarvis. The same firm completed a long stretch for the same county last year.

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*County road superintendent of Lennox and Addington.

Bituminous Penetration Surfaces

By A. B. Manson*

THIS country has now reached a state of development when its rural as well as urban roads require more than the lesser types of permanency on its main highways and yet it may not have so far advanced as to stand the expensive pavement. The bituminous penetration pavement is one of the types that bridges the two extremes. The advent of the automobile in all its forms is doubtless the chief visible propagandist of improved roads, backed by the real demand for improvement as an economic necessity. The idea of the bituminous penetration road is to get something of a more permanent nature, something with a bond more enduring than water and stone dust, something that will prevent the very life of the road from being thrown over the neighbor's fence every time a motor car passes, without the bankrupting cost of the expensive pavement.

The simplicity of construction of bituminous roads lends itself admirably to road building distant from cities and centres of population. No extensive plant and equipment is necessary. Skilled labor is not so absolutely essential though skilled supervision is desirable. Thoroughfares need not be kept closed for the long periods as in some types of construction. When the above items are considered it readily follows that the cost is not excessive or prohibitive.

Among the items to be considered in choosing this wearing surface are; it should be smooth, easily cleaned, not dusty, noisy or slippery, easy to construct, easy to repair, attractive in appearance and above all susceptible to the traffic to which it will be subjected. Assume that it is the best class of bituminous penetration pavement that is being constructed, that is, the surface is to be of stone rather than gravel or inferior material, although in general the remarks which will follow may apply to both.

Before placing the first course of stone all excess dirt and fine material should be swept from the surface of the foundation. This promotes a closer bond between the pavement and the foundation and tends also to prevent the stone being dust coated and thus interfere with the proper adhesion of the bituminous to the surface of the individual fragments. If tar is used as the cementing element in the road, a covering or coat of tar is applied to the base thus cleaned. This tar penetrates to a degree and also forms a close binder between the base and the surface.

Quality of Stone

If asphalt is used as the binder this first or paint coat is not employed. As the completed thickness of the pavement is usually two or three inches the broken stone should all pass a two-inch ring. It should consist of sound, tough and angular fragments of uniform quality free from dirt and other objectionable matter either occuring loose or adhering to the stone. The stone should be as nearly a uniform size as possible so as to produce a course of uniform texture which when rolled will have the voids evenly distributed. Wide variation in sizes, particularly running to small sizes, results in the formation of spots which become so dense that uniform penetration will be very much hindered or prevented altogether.

The stone should also be sufficiently durable to prevent the excessive formation of dust during the first rolling and before the application of the bitumen. Further, for securing the best results the broken stone should be shovelled and not dumped in place on the foundation. The common practice of dumping loads where the stone is required and spreading out the piles results in the segregation of the fine material which hinders penetration and makes the uniformity of the surface almost impossible. Best practice, which is possibly seldom followed, calls for dumping the stone on dumping boards from which it is spread by shovelling.

After the stone has been uniformly spread to a depth of three inches loose, it is rolled dry until the fragments are well set, a twelve-ton three-wheel roller usually is satisfactory and is operated as in ordinary water-bound macadam construction. The rolling should be discontinued when the stone is thoroughly keyed together and before dust begins to accumulate on the surface or the stone is crushed. The tendency is to under roll rather than over roll and in either case an inferior pavement results.

Mechanical Distribution of Binder

Possibly the most satisfactory results are obtained from the use of mechanical distributors for applying the bituminous binder. Most of the modern distributors apply the heated bitumen either by a single nozzle operated at the rear or by a set of nozzles set in a row close to the road. The single nozzle requires considerable skill on the part of the operator but on the other hand, has a wider scope. As the distributor passes over the compacted stone it is very important that rutting does not occur. It is essential therefore that sufficiently wide tires be used on the machine.

In operating a mechanical distributor it is important that applications should not overlap either at the ends or sides and that at the completion the nozzles should not drip on the road. Care should be taken that the nozzles are kept clean so that no strips are left to be later closed in by the hand pouring pot. By calculation and experience the proper amount of bitumen may be delivered on the road with reasonable precision. Adjustments in speed of travel and in feed to the nozzle may be readily arrived at by an experienced operator.

The Seal Coat

Immediately after the first application of bitumen a uniform layer of small size broken stone should be spread over the surface in such quantity as to fill the surface voids. The road should then be rolled with the addition of more stone if necessary. Good practice is to deliver the stone by a side swing of the shovel which spreads the stone evenly and gives more opportunity for the stone to come to rest in the voids. Just sufficient of this course should be used otherwise the roller will crush the excess and form a blanket or mat with little wearing ability and preventing the penetration of bitumen. The surface is then swept to remove excess of stone and fine material not held firmly in place.

The seal coat is the applied in the same manner as the previous applications except that the quantity is less, there being much less penetration. The surface is uniformly coated, care being taken to avoid excess which would form a thick undesirable mat.

Immediately after the bitumen is applied, it should be covered with a thin layer of small broken stone of good clean, hard quality or clean sharp sand. The amount placed should be just enough to fill any remaining voids and act as a thin covering over the bitumen to prevent it sticking to the wheels. Rolling then finally compacts the road and forces the particles of sand or stone together leaving a finished smooth surface.

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*City engineer of Stratford, Ont.

Final Rolling is Important

Rolling of the pavement after it is completed is a matter which appears to be slighted frequently. The rolling of a penetration road is a vastly different proposition from the rolling of sheet asphalt or of bituminous concrete having a well graded mineral content. It should be rolled when sufficiently warm so that the road is somewhat plastic. This rolling should be carried on for sometime after the pavement is opened to traffic, possibly for two weeks. Too much stress cannot be laid on the rolling or compacting of the road and the reduction of voids to a minimum.

It goes without saying that all this work should be done in the heat of Summer but in practice very often this is not the case and frequently contracts run into late Fall which of course gives rise to many difficulties. The stone is cold and chills the bitumen causing improper penetration. The stone is more apt to be damp, preventing proper adhesion.

The final dressing of small stone or sand above referred to should be left on and if necessary kept on and swept about for the first year, which very materially assists in filling the surface voids. Traffic will iron a dressing of sand if properly spread to a very smooth surface. Being smooth it readily lends itself to ease in cleaning which in turn prevents dust.

One of the most desirable features of penetration pavements is the ease of construction. Practically all the machinery required besides dump waggons is the heater, distributor and roller. If material is to be hauled any great distance the use of motor tractors will be found most economical.

Should Require Only Small Repairs

Following the capital cost of any pavement the most important consideration is the question of maintenance. Ordinarily a properly designed and constructed penetration road should require small repairs. A rejuvenation of the seal coat or its renewal when worn away should be the limit unless traffic is exceedingly heavy or the dirt hauled on the road has been ground into the surface before cleaning. However, no attention should be required for from three to five years and then a light dressing of bitumen covered with stone chips or sharp sand will replace or renew the life of the seal coat. Care should be taken that too thick a mat is not formed which will have quite a tendency to shove under traffic and form waves.

The seal coat should never be allowed to wear out as it forms a waterproof blanket preventing water from penetrating and spelling destruction. If proper adhesion to the road is secured and traffic is at all uniformly distributed it will wear away very slowly and uniformly. When sufficiently worn a coat or dressing should be applied in a manner exactly similar to the original seal coat. If on the other hand breaks occur anywhere in the seal coat they should be promptly repaired.

By maintaining the seal coat the life of the road is continued indefinitely. Frequently a break in the surface is due to lack of support from below. The cause of this may be weak foundation, poor subgrade or faulty drainage. Under such circumstances it is obvious that the proper procedure is to remove the cause of failure before attempting a repair on the surface. Further causes of failure may be unsound stone and improper distribution as well as the use of bitumen damaged or unsuitable for the purpose. Ruts appearing may be the result of improper rolling or the rutting of the stone while the bitumen is being applied, or the use of too much or too soft binder.

So it will appear that although a penetration road is possibly the simplest to build it nevertheless requires eternal vigilance on the part of the superintendent if he wishes to turn out a finished road and avoid the many pitfalls waiting, which will spell destruction to the best intentions.

What Bituminous Roads Cost

Costs at the present time are the most problematical element entering into road construction of any kind and it is scarcely safe to hazard an estimate due to the varying scale of wages paid and the uncertain cost of materials. Citing the city of Stratford as an example, the cost of laying a 3-inch bituminous penetration surface on a prepared base was 81.6 cents per square yard during 1919 as compared with 47 cents during 1915. We anticipate that the cost for 1920 will be considerably higher.

In conclusion, we would just like to add that though the penetration road may not represent the finest product in so-called permanent pavements it is still worthy of due consideration as the go-between and we feel it has a proper place to fill in the advancement of our highways and that place will be no mean proportion of the very comprehensive scheme now being contemplated.

Mechanical Handling of Stone and Gravel

By Alan Mair Jackson*

THE following may be said to cover most of the usual methods of transferring crushed stone from railway cars to wagons or trucks:

(1) Shovelling by hand over the sides to the ground and shovelling again into wagons.

(2) Shovelling by hand over the sides direct into wagons.

(3) Shovelling into skips on the side of the car which can be tripped into wagons.

(4) Shovelling by hand over the sides and loading with a mechanical loader.

(5) Dumping hopper bottom cars and loading with a mechanical loader.

(6) Dumping hopper bottom cars over a slot in the track, the bottom of which is inclined so as to discharge on to an elevator which in turn discharges to a stock pile or storage bin.

Cost of Unloading Cars

I found that last year with wages at 40c per hour, the cost of unloading by hand amounted to 20c per ton, when the material was shovelled out of flat bottom cars with about 3 ft. sides. The cost of shovelling from hopper bottom cars would be more. In fact, I find that the prevailing price for which coal unloading is contracted around Brantford by hand is 30 to 40c per ton. These, I think, may fairly be taken as average prices.

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*Engineer, County of Brant.

Shovelling by hand obviates demurrage, but entails an expenditure of almost as much as the unloading charge for reloading again into the wagon, while the reloading by hand into motor trucks higher than wagons would probably bring the cost of reloading up to 30c per ton. This method, however, of handling stone is primitive and entails having other work available at which the gang of shovellers can be placed until another car is spotted and it is probably practised only for small quantities of materials as the cost is not likely to be less than 50c per ton.

Shovelling by hand out of cars direct into wagons or trucks is obviously considerably cheaper than the first method, because it entails handling the material once only instead of twice but it costs more than one handling of material. This is by reason of the time lost by the teams standing idle while they are being loaded. With men at 40c and teams at 80c per hour and with 1½ yd. wagons, I found the cost of unloading cars to be 31c per ton. These were flat bottom cars and the teamsters shovelled, and the increase in cost over shovelling to the ground was due to the idle time of teams and shovellers, principally the former. Every locality has its peculiar advantages or disadvantages. Some have the advantage of a raised track and sunken wagon road so that cars may be shovelled more cheaply by first dumping them than by lifting the material out over the side, but considering the case of wagons on a road at the same level as the track, I believe this cost of 31c is quite usual.

Mechanical Loaders

I believe that no simple mechanical method has yet been found of unloading railway cars of stone from the top and it would seem that when cars have to be unloaded from the top, the man with the shovel will long hold his own. One method, however, of making an economy on which must always remain an expensive operation, is the use of loading skips. These are fastened to the side of the car or stand independent of it but close by, and hold about 1½ yds. Two or three may be used on one car. The skips are filled by the shovellers while the wagons are away discharging, and the wagon is very rapidly filled by tripping the skip, so that by a little arranging of the number of teams and shovellers, very little time would be lost by either.

A considerable improvement over the above methods is brought about by the mechanical wagon loader, several of which are now on the market. One type in particular can be used to very good advantage from the stock pile and the other for unloading hopper bottom cars. These machines are both portable and are of two distinct types, one, with a chain of buckets which digs into the pile and the other with a belt conveyor which requires that the material fall on the belt or be placed there. Both types deliver at a height suitable for loading a wagon, truck or trailer.

Bucket Type of Loader

You all know the difficulty of shovelling into a pile of loose broken stone and this is the difficulty which is presented to the bucket type of loader. It is a difficulty which increases with the size of the stone and is very real when the pile consists of stone of 4 inch and upwards such as is used for base course road work. This type will load a wagon in upwards of a minute and a half under favorable conditions and is operated by an 8 h.p. gasoline engine.

Under the old rule of 1 pint of fuel per h.p. per hour, this would bring the cost of running to about $3.50 for gasoline per day of 10 hours. It would be unusual to run at full load for 10 hours on account of the difficulty of having an empty wagon or truck always ready to take the place of a loaded one. It may, however, be considered that 1c per ton is a fair cost for fuel. Small gasoline engines not usually requiring highly skilled operators, either of these types can be successfully handled at very little over ordinary unskilled wages. The bucket machine, undoubtedly works better in gravel than in broken stone and costs in the neighborhood of $1,800.

Belt Conveyor

The second type with the simple belt conveyor is a cheaper machine costing about half of the former, but it requires considerably more feeding, in that it does not dig into a pile but must have the material fed to it. It requires about 3 h.p. and is usually operated by a gasoline engine. Two men can, by the use of this machine, unload a 50 ton car of coal in about 4 hours. This type operates well under a hopper bottom car as the car can be dumped after the toe of the elevator has been set in under the pocket, and so long as the material runs to it, the elevator will automatically carry it away. Owing, however, to the construction of hopper bottom cars, the four pockets of the car have each a door; two of the four doors at one end of the car open simultaneously when dumped and consequently there is a gush of material which runs out on to the track for more than the full width of the car. It will thus be seen that with the elevator set in under the pocket on one side, considerable material will run out of the pocket on the opposite side. Moreover, when one pocket has discharged itself, the opposite side must be shovelled out by hand and these contain on an average 5 tons. It will thus be seen that in unloading a 50 ton car, probably 10 tons has still to be shovelled by hand.

Speaking generally of these two types of wagon loaders, they are capable of a variety of applications and have very real spheres of usefulness, not only in unloading cars but also in loading to and from stock piles and in gravel pits. The lack, however, of storage puts these machines in a different class from those which are operated in connection with a storage bin.

Slot, Elevator and Bin Method

The most economical method of handling stone from railway cars to wagons or trucks that I know of is by the slot, elevator, and bin method. A slot 4 feet deep across the track is excavated 16 in. wide between ties and is lined with ties one on top of the other. A plate some 9 ft. long x 16 inches wide is set in this slot at a slope on which stone runs freely, i.e., 30° from the horizontal. The plate should be set so that the largest material will pass under the rail at the upper end and the lower end so that it will discharge on the buckets of an elevator. The elevator is set in a pit at one side of the track with the centre of the lower tumbler about 5 feet below base of rail. With this setting, a 30 ft. elevator standing at 60° from horizontal will have sufficient length to fill a 55 ton bin. The motor consisting, in this case, of a 9 h.p. oil engine is set under the elevator in a small portable house and provided with a clutch drive, by 6 in. belt, onto the jackshaft of the elevator. The elevator is of standard construction 14 in. wide and delivering about 120 buckets per minute.

The flow of stone to the elevator is controlled by an ordinary slide door operated by a lever and is set between angles fastened to two plates lining the sides of the 16 in. slots at the lower end. The pit in which the elevator is set is made large enough for the operator to get down to the lower tumbler and is timbered on the track side and decked over. A trap door is left in the deck so that the lever operating the stone feed may be got at and cover boards are provided for the slot across the track so that the whole may be left safe when not in operation. The usual spacing of ties is about 20 in. centres, which leaves approximately 11 in. space between ties. I found that railway companies would give permission on sidings for ties to be spread to an opening of 16 in. if a piece of rail was put in under the running rails as an extra support. As they supplied the pieces of rail, this seemed easy to me, though it was necessary to sign an agreement with the railway companies relieving them from all responsibility for accident.

Unloading Costs

Two of these outfits were installed by the county of Brant this year and operated during the construction season. The cost of unloading cars and loading into wagons by this method has been about 3c per ton. The total kerosene purchased at 20½c for unloading 1854 tons was 33 gallons giving a cost for fuel of about 4/10c per ton. A 50 ton car can be unloaded in 2½ hours, though allowing for oiling round and starting up, I figure 3 hours about a fair allowance. The operator in each case has been an unskilled man paid 40c per hour. The bin used discharges through four 12 in. x 12 in. openings in the bottom by means of any one of which a 1½ yard wagon can be filled in 30 seconds. The height from the ground to bottom of bin is 6 ft. 8 in., though this can be increased by lowering the roadway. The cost of unloading 50 tons may be taken as follows:

3 hrs. time at 40c.	$1.20
50 tons at 4/10c for fuel	.20
Oil and waste and grease	.10
Total	$1.50

These outfits cost approximately $1,800 made up as follows:

Engine and clutch	$ 545.00
Elevator	650.00
Lumber for bin and pit	215.00
Ironwork for bin and slot	225.00
Construction	165.00
Total	$1800.00

I estimate that the unloaders can be taken down and re-erected for about $200.

A bin of this capacity is not portable in the strict sense of the word but the bins used in Brant county last year were made so that the whole structure could be readily taken apart. No nailed parts would have to be torn out except the lining boards of the end of the bin, each of which requires two 4 in. nails, so that no loss should occur in knocking down the bin.

In most counties, I believe stone unloading points can be located on the railways from which it would be possible to do several seasons' work.

I assume that the commonest method of unloading cars is to shovel out into wagons which will cost in the neighborhood of 31c per ton or $15.50 for a 50 ton car. Taking the cost of unloading by the slot, elevator and bin method at 3c per ton or $1.50 for a 50 ton car, a saving can be effected of 28c per ton or $14 per car. A season's work for one macadam outfit might, I think, be fairly placed at one car per day for 140 working days. This would represent a cost for unloading by the one method of $2,170 and by the other of $210, or a saving of $1,960 for one season, a little more than the cost of the outfit. I should consider the investment worth while if the outfit paid for itself in three years.

Concrete Road Construction

By H. E. Davis*

CONCRETE pavements present many characteristics totally unlike those of other forms of the more permanent types of pavement. The fact that they are composed of large monolithic slabs makes it necessary to consider certain features of construction not usually important in these other forms. The strength of concrete to resist stresses of all character depends on the strength of the matrix or mortar holding the aggregate together, assuming of course, that we use an aggregate of sound, hard particles. The concrete being made of various size particles it becomes necessary that none of them should be loosened under the action of climatic or traffic conditions.

Preparation and Treatment of Subgrade

It is practically impossible to formulate specific directions for the preparation of subgrades that will be of general application. Every section of road involves problems that are complicated by financial, geological and physical conditions.

The necessity or at least the desirability of spending more time and money upon thorough preliminary investigation cannot be too strongly emphasized. Such expenditure is in the end a real economy.

The most met with cross sections are as follows:—

(1) Subgrade parallel to wearing surface.

(2) Subgrade crown somewhat less than concrete wearing surface.

(3) Flat subgrade, in this case the crown is given by varying the thickness of the concrete. This is the one most generally used.

Whatever form is used however, the sub-base should be made of uniform texture, should be finished true to the specified outline and should be kept true to the specified outline, that is free of the tracks, holes and ruts, until the concrete is laid.

Shoulders, Crowns and Grades

Experience in various localities with the shoulders along concrete paved roadways has been variable. This is without doubt due to the variation in kind and density of traffic on these roads. Where shoulders will not stand up under the turnout of traffic along a concrete road an additional width should be considered or the use of a crushed stone shoulder is recommended. The recommended width of shoulder to edge of embankment should not be less than 4 feet.

Unlike some types of pavement, concrete surfaces are undamaged by water, unless it finds its way into the subgrade. Theoretically, with perfectly surfaced concrete, only a slight side fall is required to accomplish unwatering. Data that is available would indicate that in case of uniformly thick pavements, the amount of centre longitudinal failures, has varied directly with the amount of crown. With few exceptions the crowns most generally used range between 1/65 to 1/100 of the width of the pavement.

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There would appear to be no reliable information on the relative slipperiness of concrete pavements. Generally speaking concrete road is less slippery than other classes especially after only a slight rain has fallen. It would appear that it is a question of placing the concrete on the grades rather than the grade itself.

Specifications generally call for concrete roads to be 6 to 8 inches thick. It should however be borne in mind that owing to the monolithic structure of concrete, it is necessary to have the cross section true to grade so that additional concrete need not be employed to fill the depressions and uneven places in the subgrade.

Aggregates for Concrete Roads

The most important success in construction of concrete highways will depend upon the materials used. All roads, permanent types or otherwise, must be designed and built to withstand three different destructive agencies, namely, traffic, weather and structural stresses. The wearing resistance of concrete roads subject to given conditions of traffic and weather will depend upon the following factors:—

(1) The properties of the concrete materials; (2) proportions and consistency of mix; (3) thoroughness of mixing; (4) method of placing; (5) surface finish conditions of seasoning, and (6) age of concrete.

The aggregates constitute 75 to 85% of the material in concrete roads, hence the resistence to weather and traffic and the final integrity of the structure depends largely on the aggregates and the way in which they are incorporated.

For concrete road construction, sand is generally much coarser than that used in building construction. The advantage of using coarse sand is not only to obtain strength and density but to prevent, near the surface, the formation of a thin layer of fine sand and cement. Sand should be free from vegetable or organic matter or the concrete is liable to harden not at all or too slowly to be serviceable. Low voids should be secured since the strength and the working ability of the concrete will thus be greatly improved. A well graded natural sand with coarse aggregate screened out will show voids as low as 25%; in a poorly graded sand the value may be as high as 38%. The voids in crushed stone frequently run to 50%.

The use of gravel in the most recent specifications calls for screening into sand and gravel, then recombining in proportions according to voids. Pit-run gravel generally contains sand in excessive proportions to gravel. If gravel contains 40% sand and a very rich mix is used, say, 1-3½, a fair concrete can sometimes be produced but it is always cheaper in such cases to screen the gravel and remix the sand and stone in proper proportions. In this particular instance there will be a saving of ¼ barrel of cement per cubic yard of concrete by using proportions of 1-2-3, also the resulting strength may be increased.

The sizing of stone called for in concrete road construction, requires little screening and only those screens need to be used that will enable you to obtain a stone that will pass a 2 in. ring and be retained on a ½ or ¼ in. screen.

The concrete mixers generally used are those of batch type, provided with traction driven power loader and automatic regulated water tanks. Mixers with boom and bottom dump buckets of sufficient size to convey one complete batch, are those most commonly used and specified.

The filling of the skip is accomplished in practice in two ways:—shovelling directly from supply piles, or loading wheel barrows. The former means, however, is generally discouraged, as accuracy is impossible in obtaining the correct proportions, and besides the entire loading gang loses time waiting while the container is raised and lowered.

The question of correct proportions for concrete is being taken up in practically every laboratory in Canada and the United States, the result of investigations accomplished so far indicating that unsatisfactory concrete will result from the use of best aggregates if they are not properly proportioned.

The general recommendation of 1: 1½: 3 or 1:2:4 mix must be considered only general and it is most essential that the material for use be thoroughly tested out under laboratory conditions before used in construction.

Consistency

The question of correct consistency is in most instances, treated with the proportioning of aggregates, as the make up of this combination results in the best concrete. Most engineers would prefer dealing with the question of consistency first and allowing the question of proportion to be dealt with secondly.

A scheme that was used on the work that I am most familiar with proved to be of great value in keeping the consistency a constant. The method was to incline a board at various angles, placing a shovel full of green concrete at one end, then incline the board to an angle at which the best predetermined consistency from laboratory investigation showed. After heavy rain, stock piles absorb a considerable quantity of water and with the scheme mentioned above it is quite easy to keep the same consistency as was first used. It requires very little time to determine the right angle and it has the advantage of keeping the water content fairly constant and assists in placing and finishing.

Joints and Reinforcement

Studies have been made of various slab lengths under various weather and subgrade conditions and it would appear that on sandy subsoils, the slab length can be lengthened to 50 or 60 feet, and on clay subsoil to 35 or 40 feet. The more recent tendency however has been to increase the slab length to 70 and 80 feet for sandy subsoil, and 40 to 50 feet for clay subsoil. This is a matter that should be given due consideration as climatic conditions and temperature change, such as we have here in Ontario, must be taken into consideration.

It is generally recommended that reinforcing be placed in concrete roads over 20 feet in width. The amount of reinforcement to be used per sq. yard should be determined by an engineer familiar with local conditions. The temperature range and percentage of moisture varies with each locality. It is evident therefore that each roadway must be studied to suit these conditions.

Finishing and Curing

Prior to finishing, it is essential that the surface of the concrete be brought to the proper grade and cross-section. The manner of doing this will depend primarily upon the width of the road or whether side forms or curbs will be used to guide the strike board.

During hot weather it will usually be found necessary to cover the surface of the finished pavement with canvas as soon after floating or belting is completed as the effect of covering assists in keeping a more uniform temperature over the finished work, which results in increased strength and assists in giving a better wearing surface to the road.

The process of curing involves two distinct features:

(1) Protection until the hardening of concrete has reached its final set; (2) protection after final set.

In the first instance a canvas is supported over the road by means of portable frame work 2 feet above the surface on which is placed canvas.

For protection after final set, the canvas covers are removed and the concrete covered with earth or other water retaining material. This covering should be at least two inches thick and should be kept thoroughly wet for a period of from ten to 14 days.

Street Paving in Towns and Villages

By E. A. James*

ECONOMICAL municipal administration, inexpensive transportation, convenience and cleanliness demand paved roadways in towns and villages just as surely as present day commerce requires railroads. The building of provincial highways to the limits of towns and villages creates a new demand for pavements in the urban districts which must be met.

Unfortunately we have not been planning for pavements as we should. Streets have been graded, sidewalks laid, shop and dwelling entrances constructed without any regard to future paving schemes, and the grade line must be struck if the pavement is to be either economical of construction or easy of travel. In every town and village where we have supervised paving work the cost of taking care of improperly constructed sidewalks and haphazard doorsteps has been many times the fee that would have been required to pay for proper plans when the street was first graded or sidewalks laid.

Preparing Plans and Profiles

A survey for pavements should usually cover not only the street to be paved, but the streets intersecting and the drainage area tributary to the street defined. Following this general plan, a detailed survey of the street should be made. In making this survey the building line, street limits, sidewalks, poles, hydrants, trees and other obstructions should be accurately located. In the roadway itself, sewer, water, telephone and electric light manholes should be located as to position and depth. Careful measurements should be made of existing water outlets, such as culverts and old drains, and this information carefully plotted to a suitable scale, preferably 40 feet to the inch. On the profile will be shown the elevation of the doorsteps on both sides of the centre line, the sidewalk elevation and the elevation of the intersecting streets. In taking levels for the profile, levels should be taken every hundred feet, or more often if there is a marked change in the elevation of the ground at the centre, quarters, curb line and two feet back of the curb. These levels will, in addition to giving a profile, serve as a basis for calculating the quantities.

Alignment

The alignment of roads in towns and villages is usually within such confined limits as to admit of little variation, the controlling points usually being the telegraph and telephone poles, electric light poles, fire hydrants and tree lines. With these controlling points fixed, the only consideration is that of safety and the expense of construction. Of course, when possible the centre line of the pavement should be the centre line of the street, although on streets which have a different elevation on either side the centre line of the pavement is sometimes put off centre to assist in lowering or raising the curb line.

Grades

The grade established on the profile will in most cases be governed rather by the elevation of steps of buildings than the traffic requirements of an economic grade. Except in unusual circumstances, the maximum grade now found in towns and villages will be found to be 6 per cent. This grade was established in the days when roads were built for horse driven vehicles, and in a rough way the streets were graded to a 6 per cent. maximum. The expense of lowering this grade, having regard to land damages, will usually be greater than any saving in transportation charges. It is not yet determined what grade is an economic grade for motor vehicles. The question is being carefully studied, having in mind the fact that the maximum grade for motor vehicles is the steepest grade that can be negotiated with minimum of power. Until motor vehicles are better standardized, there is not likely to be a very satisfactory solution to this problem.

At the beginning and end of all grades where the grade changes abruptly, vertical curves should be used so as to provide gradual change in direction, which is conducive to easy riding. If hauling were the only consideration, a level grade would be the most economical, but where the road surface is comparatively smooth this is not so important, as ordinarily a road surface causes greater resistance to traffic than the grade.

Width of Pavement

Having settled the alignment and the grade, the width of pavement should be the next consideration. The limit of width of vehicles operating on Ontario highways is 90 inches, so that it will be seen two trucks would theoratically pass on a 16 ft. roadway. Practically however, due to overhang, the trucks might operate on two feet less, so that theoretically an 8 ft. pavement would be sufficient for one line of traffic. When the traffic increases so that vehicles pass or meet one another at a greater rate than ten turnouts per hour, the pavement should be wide enough for two lines of traffic, of for safety, 18 to 20 feet. Perhaps better still, for two line traffic, 18 ft. roadway with 3 ft. shoulders on either side.

It is now customary to pave residential streets 28 ft. wide, as this permits vehicles to be parked on either side of the roadway, leaving a width between sufficient for passing of other vehicles, and also provides room for turning. Where the blocks are short and the traffic not dense, 24 feet of pavement is sufficient. On business streets where space may be required for three lines of traffic, streets are usually paved 36 ft. wide. This allows for delivery waggons to stand at the curb, leaving plenty of space for moving traffic, both slow and rapid, to pass through.

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*Engineer to the Toronto and York Highway Commission.

Crown

The crown given will depend on the grade, type of pavement, and in a lesser degree on the personal preference of the engineer. Formerly pavements were constructed with very high crown. This is not at all necessary with water-proof surfaces, whether bituminous or concrete. On the highly crowned pavements three-quarters of the drop from the crown to gutter came between the quarter and the curb line, thus throwing extra strain on the wheel of the vehicles. With bituminous materials built with a high crown there is a tendency to creep to the curb, and because of this the first repairs are required along the gutter.

For permanent pavements we now adopt a maximum crown of 4 in. for 24 ft. pavement; 4½ in. crown for a 28 ft. pavement and up to 5½ in. for a 42 ft. pavement. When the pavement approaches an intersection with a rising grade across it, the curb and gutter are tilted, the centre remaining the same. The curb on the high side is raised and on the low side dropped, and the crown thrown over on the quarter on the higher side.

At pavement intersections it is good practice to raise the crown an inch or an inch and a quarter above the grade as shown on the profile. This adds to the appearance and assists in shedding the water at intersections.

Storm Sewers

Having decided on the grade and width of pavement, it is now possible to plan for the removal of storm water. If the pavement is a comparatively narrow strip in the middle of the highway, it may be possible to dispose of the water by open side ditches, but in towns and villages the better practice is to construct the pavement with curb and gutter, and to provide for the removal of storm water by pipe drains provided with suitable catch basins and manholes. The size of the sewer will depend upon the grade, distance to outlet and catchment area. It is good practice to design for the removal of 1½ inches of rain per hour. Where possible it is best to locate the sewer outside of the curb of the pavement, more especially if the storm sewers and pavements are to be laid in the same year. Where this is not possible, and the sewer is laid under the pavement, great care should be taken in backfilling. As storm sewers do not need to be laid at a greater depth than four feet, this backfilling can be so made as not to endanger the pavement.

Selecting Type of Pavement

The selection of the most desirable type of pavement demands a knowledge of the characteristics and costs of available raw materials which go into pavement construction, together with a knowledge of the suitability of those types of pavements to the present and possible future traffic. In street paving attention should always be given to aesthetic considerations, but among the various standard types of pavements that are now available, all, when properly constructed, have a pleasing effect.

A whole book might be written on the selection of a type of pavement, but just here reference will be made to a few of the principles that should govern selection. Now that the Loads of Vehicles Act specifies the weight of traffic that may be carried, there is more definiteness than formerly in connection with the selection of foundation. A physical examination of the soil and sub-soil will have to be made to determine whether a concrete base eight inches, six inches or five inches may be used, and experience only will guide one in forming an opinion. It may be found more economical to use a consolidated broken stone base. It will usually be found that a rolled stone base should be 25 per cent. heavier than a concrete base. Conditions sometimes warrant reinforcing the concrete base. In fact, frequently we have considered it more economical to add reinforcing than to add concrete when the soil and sub-soil are soft.

For a wearing surface one has a choice of concrete, bituminous bound macadam, bituminous concrete, sheet asphalt, bitulithic, brick and block, etc., each having merit when traffic and local materials are considered.

Last season we laid several miles of bitulithic, using a gravel aggregate, because near the town where we were paving there was a large and inexpensive gravel deposit. In our 1920 work we expect in at least two towns to build fifty thousand square yards without using a ton of stone, and in each case bituminous binders will be used. Local materials are going to be more than ever in demand, because of the present high, and the probable future higher, freight rate. Of course in selecting the type of pavement, one must have regard to the grade, as some of the more economical pavements are very smooth and slippery. The use of bituminous concrete or sheet asphalt up to a 4 per cent. grade is quite permissable.

Bituminous macadam up to seven per cent. will be found to give good traction, and water bound macadam up to 12 per ent. can be negotiated without great difficulty.

Financing

The method of financing the street paving in towns and villages varies all the way from the whole cost being borne by the municipality to the municipality paying but one per cent. Paving may be undertaken as a local improvement, either on petition, on the initiative or on the forced local improvenent scheme; or the Council may submit a By-law to the people to raise funds for paying for all the pavement or part thereof.

A canvass recently made of 26 Ontario towns showed that in 66 per cent abutting property pays all; in 8 per cent abutting property pays 50 per cent; in 24 per cent abutting property pays more than 50 and less than 60 per cent; in 2 per cent the municipality pays all. It might be pointed out that these percents include the street intersections and flankages which the Local Improvement Act requires the municipality to pay.

A deputation from southwestern Ontario waited upon Premier Drury and Hon. H. C. Nixon recently, asking for legislation giving powers for town planning. The deputation submitted two suggestions for legislation for the government's consideration. The following gentlemen represented the different municipalities: Fred. Carr, Oakville; Prof. Hutt, Georgetown; Mayor Westbee, Guelph; Ald. Riffer, St. Catharines; J. McAdams, of the Chamber of Commerce, Sarnia; Ald. J. M. Shuttleworth, Brantford; Mr. Breithaupt, Kitchener; Ald. McQueston, Hamilton; A. Kinzinger, Niagara Falls; H. Meill, Windsor; Mayor Little and John Cottam, London; Mr. O'Brien, Toronto Civic Guild, Toronto. The Premier promised consideration of the schemes.

Meeting of Ontario Good Roads Association is Most Enthusiastic on Record

Largest Gathering in History of Organization Hears Addresses of High Order and Participates in Keen Discussion—Hon F. C. Biggs Explains Future Road Policy of Ontario

BOASTING a record attendance the eighteenth annual convention of the Ontario Good Roads Association got away to a flying start on the afternoon of Wednesday, March 3, at the York County Buildings, Toronto. An attendance of 330 was registered which is the best indication of the interest shown in the good roads movement.

In opening the proceedings of the association the president, Mr. K. W. McKay, of St. Thomas referred to the progress of the good road movement and the growth of public sentiment in favor of improved highways. He pointed out that there are now 10,000 miles of roadway under the county systems, of which 223 miles are included in the suburban areas. To show that improved roads would benefit both the cities and the rural districts, he quoted figures to show that 47 per cent. of the automobiles are owned in the cities, with the balance of 53 per cent. owned in the country.

The bulk of Mr. McKay's address, however, was a review of legislation. Several recommendations were made, looking to the equalization of opportunity and expense, an improvement in the method of financing, and the alleviation of the liability of municipalities for accidents on highways. Those portions of Mr. McKay's address treating of these features are abstracted below:

Assessment for Benefit

The trend of all public legislation should be towards the equalization of opportunity and expense. In Ontario the legislature has kept this in view. One matter that should receive immediate consideration is the advisability of imposing a direct assessment for benefit. The improvement of any highway has the effect of increasing land values in proportion to expenditure necessary to provide a road sufficient to accommodate the traffic over it. When a county road is constructed, it is generally of a higher standard that the average township road and the benefits derived by the district in which it is located is proportionately greater. Property values are largely influenced by improved transportation facilities, be they in the form of steam railways, electric lines or well built roads. When a county completes a system of roads under the provisions of the Highway Improvement Act, the value of the property is increased because local transportation facilities are improved. The township in which the roads are located are relieved of the care of many of the more important highways and the citizens generally derive a direct benefit from this, as well as from the improved means of transportation in their midst.

Two Defects in Legislation

The present legislation appears to be lacking in two respects if perfect equalization is desired. Townships in which provincial highways or county roads are located should be required to make a direct contribution towards the cost of construction and maintenance and the councils should have the right of shifting their liabilities to the property owners benefited by the construction of the roads. That public improvement does increase the value of land is well recognized, but there is no hard and fast plan for determining the benefit derived. This can only be fixed after each individual case has been considered by an engineer, competent to report thereon. To enable this to be carried out, each township should be looked upon as a construction area in so far as roads located therein are concerned and their contribution to the cost of the roads, limited to from twenty to thirty per cent.

The Ontario Highway Commission made a comprehensive report on the effect of good roads in raising land values and the necessity for a proper assessment. From information before the executive of this association last year the assessors' valuations of land along the Toronto Hamilton Highway in at least one township were shown to be less than they were before the highway was constructed and that the sales had been made at very considerable increases over their values.

The Highways Department should procure a report on actual conditions in different parts of the province with a view to having the assessment law properly administered.

Finance of Highways

The Highway Improvement Act is a very complete piece of legislation. There is, however, one matter the Highways Department should consider and that is the necessity for some supervision of debenture issues for road expenditures.

The provision of the Act providing for the issue of debentures for any expenditure and limiting the debenture term to thirty years is too general. The Department should insist that this be limited to the estimated life time of the work and the maintenance system to be inaugurated. It is not good financing to extend the debenture term so that a road will be worn out and reconstructed before the first debenture is wholly paid. The supervision of debenture issues by the Department is suggested.

Liability for Accident

The general use of motor vehicles and changed traffic conditions is directing attention to the provisions of the Municipal Act, Section 460 which reads as follows: "Every highway and every bridge shall be kept in repair by the Corporation the Council of which has jurisdiction over it, or upon whom the duty of repairing it is imposed by this Act and in case of default, the Council shall be liable for all damages sustained by any person by reason of such default".

There can be no question but that the law respecting actions against municipal corporations for damages caused by the non-repair of highways is in a very unsatisfactory state. It is submitted that a municipality should not be liable for defects in highways unless the defect is of its own direct creation and that Section 460 should be amended by eliminating the words imposing a civil liability. No such liabilitty has been imposed by statute in any other of the provinces of Canada except the province of Manitoba and in the case of that province there is the following provision: "Provided, however, that the liability of such corporation shall be limited to the portion of the road on which work has been performed or public improvements made by the municipality."

In Ontario, the liability to repair extends to the whole width of the highway and so strictly are municipalities dealt with that practically every person using the highway is insured against accident. The matter has been brought to the attention of the legislature many times during the past fifteen years by provincial deputations and by this association in co-operation with the Ontario Municipal Association.

Some municipalities have adopted the plan of taking out indemnity policies protecting them from personal and property liability, resulting from accidents on highways under their control. This is to some extent an innovation and as long as the premium charges are reasonable, is a businesslike proposition, the same as insurance for any other purpose.

Official Welcomes

The Lieutenant-Governor, Mr. Lionel H. Clarke, extended the official welcome to the delegates and assured them that his sympathies are wholly and entirely with the objects which the association has in view. Mayor Church of Toronto gave the welcome to the city.

Hon. F. C. Biggs Explains Road Policy

The outstanding event of the first session and indeed of the whole convention was the explanation of the new road policy of Ontario by Hon. F. C. Biggs, Minister of Public Works and Highways.

1824 Miles of Provincial Roads

In outlining the road-development policy of the Ontario Government Mr. Biggs definitely named the 22 roads upon which the Government intends to commence improvement work as soon as conditions will permit in the Spring, and he explained that these 22 roads, taken in addition to the existing Provincial highway scheme of 422 miles, brings the grand total of mileage up to 1,824.7. This huge system of roadway construction plans to touch every county in the Province, and while the Hon. Mr. Biggs, recognized that it would be impossible to bring the 1,824.7 miles of proposed roadway up to perfection within the five years allotted for their construction, he did hope that at the end of that time they would be so near a state of perfection that all Ontario would be proud of them. At the same time, Hon. Mr. Biggs pointed out, that there had been great care exercised in the selection of the roads which are now being brought under the Provincial scheme. In making their selections, they had taken into consideration the amount of traffic now passing over the roads; they had considered the market possibilities of the population centres touched, the automobile and truck traffic which would be served, and the agricultural needs of the districts tapped.

The roads named by the Minister, which go to make up the 1,824.7 miles mentioned above, with their approximate mileage are:

		Miles
1.	Windsor to St. Thomas (Talbot Road)	126
2.	St. Thomas to London	16
3.	Maidstone to Lambeth (Longwoods Road)	105.5
4.	St. Thomas to Niagara Falls	141
5.	Jarvis to Hamilton	27
6.	Hamilton to Chatsworth	103
7.	Arthur to Kincardine	64.5
8.	Sarnia to Road No. 11	62.7
9.	Stratford to Brampton	77
10.	Hamilton to Kitchener	32
11.	Stratford to London	47.5
12.	Stratford to Goderich	42.5
13.	Toronto Hamilton (Dundas St.)	37
14.	Cooksville to Owen Sound	102.4
15.	Toronto to Bradford	31
16.	Bradford to Severn River	55
17.	Toronto to Rouge River	11.8
18.	Whitby to Lindsay	36.5
19.	Port Hope to Peterboro	26.8
20.	Kingston to Ottawa	102
21.	Ottawa to Point Fortune	69.5
22.	Ottawa to Pembroke	89
23.	Existing Provincial System	422
	Total	1,824.7

Method of Construction

In elaborating upon the method to be employed by the Government in pressing their roadway construction as rapidly as possible, the Minister stated that the work would start with the centres of population and would reach out into the rural districts, as he felt that by using this method the most people would be served in the quickest possible time. One of the first duties of the highway engineers would be to go over the existing roads and pick out the weak spots, the places which are in the greatest need of standardization, and these strips would be improved as rapidly as conditions would permit. This would tend to bring about uniformity of construction. Each road, he added, as soon as it was taken over by the Provincial Highway Department, would pass out of the control of the County systems.

In pointing out that the Province is relieving the counties of much of their present county roadway programmes, Mr. Biggs trusted this would not mean that any county could feel that its work is being done for it, and that accordingly it could let up on its own systems. On the contrary, he hoped that each county would appreciate that the Province is taking off its hands the most expensive portion of its proposed roadway construction, and that, therefore, its hands will be free to go ahead with the improvements of a much greater mileage than it had ever been before counted upon. With the more expensive of the roads being looked after in each county, the county should come along and improve any where from 150 per cent. to 200 per cent. of the original mileage counted upon. This could be done, he felt, at no greater cost than the counties had planned upon spending upon their original programme.

Townships Able to Enlarge Program

Exactly the same thing should apply to township construction. For the counties, in enlarging their present programme, would necessarily have to take in many roads now coming within the township jurisdiction. These roads, in their turn, being the most expensive of the roads on the programmes of the townships, and passing as they should, under county jurisdiction, would mean that the townships should be free to spend exactly the same sum planned upon, but upon a greater number of roads.

Referring to the suburban areas the Minister pointed out that the Government now proposes to pay 40 per cent. on all work, whether construction or maintenance; whereas the present arrangement is that the Government should pay 20 per cent. of the cost of maintenance only. "We are outlining a progressive policy in order that no road should go down the hill" the Minister continued.

Maintenance to be Insisted On

Too many roads have been built in Ontario, and have been left to wear out. I cannot emphasize too strongly the fact that you must pay attention to the maintenance". The Department of Public Works, he continued, has no desire to be mean or rash, but he wanted to throw out the warning that in any district where proper attention is not paid to maintenance, the Government will step in and cancel its percentage contributions. In order to check up each district, a staff of expert engineers will be employed constantly to see whether or not maintenance is getting its due share of attention, and if it should be found that a district is overlooking that feature of road work, then grants will be stopped.

Mr. Biggs told the township representatives that it was a new departure for the Government to help out the townships to the extent of 20 per cent., but he recognized that trunk roads lose much of their usefulness if they are not supported by feeders. In order to encourage townships still more, he repeated a statement made some time ago by the Government that instead of paying the present 25 per cent. of the salaries of township engineers, up to $600, he would pay 40 per cent. of their full salaries, no matter what the amount. An effort would also be made to give the township standardized ideas on road construction and maintenance.

Special consideration, he explained, would be given to municipalities with less than 1,500 of a population, through which any Provincial highway might pass. In order to help these municipalities, the Government would build their roadway for them, as he felt that unless something like this were done, it would result in a large number of poor strips of roads in the centre of the Provincial systems. Many of these small centres, he stated, are in a poor financial condition, and if left to construct their own roadway for the full length of their extended municipal boundaries, they would probably be unable to do the work promptly or well.

Roads Through the Villages

Another type of consideration would be given to the municipalities of 1,500 and over. In such cases, the Government Provincial engineers would not stop their construction at the edge of the municipality's declared border—as these borders often extend far beyond the buildings—but would build the roadway right up to the population limit. From that point on, the Government would construct the road through the town according to the regulation width, and the municipality would have the chance of extending that roadway to the curbs.

Brigadier-Gen. C. H. Mitchell, who moved a vote of thanks to the Minister, referred to the fact that the University of Toronto is now paying particular attention to the training of engineers, and he hoped they would be able to turn out sufficient well-qualified men to help the Government for all time to come in their roadway policies. The University had recognized the growing importance of highway construction, and accordingly had planned to give this department of engineering particular attention.

Mr. T. W. Smith, 1st vice-president of the Eastern Ontario Good Roads' Association, extended the greetings of Eastern Ontario, and assured the Minister that his association would do what it could to further the Government scheme.

At the Thursday morning session the chairman, Mr. K. W. McKay, president of the association, read a resolution which had been handed in to the Committee on Resolutions, endorsing an increase in motor license fees, this increase to be utilized to help defray the cost of road building.

"Good Roads" Campbell Explains Application of Federal Road Aid

The chairman then called on Mr. A. W. Campbell, Dominion Highway Commissioner, who delivered an address on "Federal Aid," which is reviewed below.

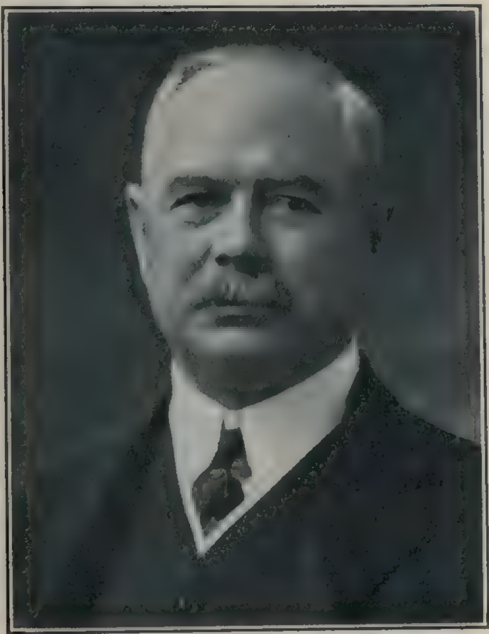
"On July 7 last," commenced Mr. Campbell, "the Dominion Government passed an act providing $20,000,000, to be divided among the different provinces, in proportion to population, to be used in paying 40 per cent. of the cost of building roads throughout the country, to be designated by the Provincial Road Departments and approved by the Federal Government. It was thought better to provide a large sum, which would enable the different provinces to lay down a road building program to cover four or five years, than to submit this money in small amounts from time to time. The first regulation in connection with the grant is that the different provinces submit to the Federal Government, a map outlining the proposed roads to be constructed during this five year period. Ontario's program, now completed, provides for the construction of 1800 miles of roadway. This is a big undertaking, the carrying out of which will mean a great deal of care and study on the part of the government and the various road departments. Owing to the high cost of materials and labor, there is no doubt that this program is going to involve a tremendous expenditure, but I believe the benefits to result unquestionably justify this outlay.

Consider Demands of Traffic

"As to what the character of the work shall be, is a question that is going to give you considerable worry. We believe that the improvements carried out should be as nearly as possible in keeping with the demands of traffic."

Mr. Campbell, at this point, emphasized the importance of careful consideration being given to the demands of traffic, and the estimated increase in traffic due to the improvements at different points, so that the proper road to meet the various conditions might be constructed. "It is impossible for us," he continued, "to raise sufficient money to go along recklessly establishing expensive roads where traffic does not justify the expenditure. On the other hand, where a road requires more expensive construction, it is good business economy to make these expenditures. These different classes of roads all have their place in the country's road system."

The speaker pointed out that the Dominion grant does not cover any bridge which it may be found necessary to build on these roads, but it does include culverts up to 20 ft. in width, and he urged the importance of careful consideration being given to their construction.


A. W. Campbell, Dominion Highway Commissioner, who showed active interest in the proceedings of the Ontario Good Roads Association

Machinery to Keep Cost Down

"Much thought will also have to be given," continued Mr. Campbell, "to the question of maintenance. Maintenance, to my mind, is a matter to which we have not given the attention, in the past, that it deserves. Construction without provision for maintenance is a big mistake. The employment of capable men for the direction of the work, the selection of quality materials and the utilization of modern machinery, as far as possible, are essential points in the successful carrying out of road construction. The cost of labor and the hire of animal power at the present time are so high as to make construction almost prohibitive; therefore it is a part of economical construction to employ modern machinery wherever possible to keep down the cost of the road."

Mr. Campbell, in his closing remarks, stated that it was very encouraging to note the number of road departments that are being established all over the country and the enthusiasm which is evident on every hand, and promised the co-operation of the Dominion department in the best development of the province's system of good roads.

* * *

Discussion on Liability

Following Mr. Campbell's address, Reeve Ward, of Kent County, brought to the attention of the members that clause in the present Act which holds municipalities responsible for accidents occuring on highways within their boundaries. He urged that some action be taken during the convention to secure an amendment of this act, relieving municipalities from this responsibility, which he thought unfair. Considerable discussion took place on this question, several delegates quoting cases where their respective councils had been forced to pay damages for accidents occurring on the highways, when no actual proof was available that the complainant was obeying the road laws with regard to speed, etc. It was at first proposed that a representative delegation interview the Attorney General, Hon. Mr. Raney, on this question, but it was finally decided, on suggestion of the chairman, that Mr. Raney be invited to the afternoon meeting to discuss the matter thoroughly with the members.

Hon. Mr. Raney paid a brief visit to the convention in the afternoon and announced that, in response to requests of members, his department would give consideration to the matter of amending the Municipal Act. Many of the members present expressed the opinion that in its present form the act made it too easy for persons sustaining loss or injury through accidents on the highways to bring actions against municipalities. He also stated that the appointment of Mr. J. E. Elliott, ex-M.P.P. for West Middlesex, as special counsel to the Attorney-General, would enable his department to deal in a comprehensive manner with the legal aspect of the good roads legislation.

At Thursday noon the delegates were the guests of the Lieutenant-Governor for luncheon. There were 326 present, the delegates being received by Mr. and Mrs. Clarke and Miss Clarke. All the Cabinet Ministers, with the exception of the Premier, were present.

A vote of thanks was extended to the Lieutenant-Governor for his hospitality, and the delegates expressed themselves well pleased with the reception they had received.

Concentrate on Maintenance and Defer Construction—By A. R. Hirst

At the Thursday afternoon session the feature was an address on "The Necessity for State Highways," by A. R. Hirst, C.E., State Highway Engineer, Wisconsin Highway Commission. In giving the Ontario delegates the benefit of the experiences of the State of Wisconsin, which started its active road policy in 1907, Mr. Hirst declared that too much attention could not be paid to maintenance. When he started work in connection with highway development, his idea had been that money would be wasted unless it were spent on the construction of permanent highways. Since that time, he has completely reversed his views, and so declared his conviction that the best way to get a quick return for money expended would be to start a maintenance system on the roads, as they now exist, and then, when the present highways have been brought up to a passable state, the engineers could start in with the construction of the permanent roads. Mr. Hirst urged a cautious and sound policy in road building and cautioned the delegates against a mushroom growth that would make us forget the old rule of safety and sobriety.

"I have been in this road game in three American states for more than sixteen years," Mr. Hirst told his audience. "I have seen the road business in the States rise from a condition where very few were interested in it to where it has become the greatest of our engineering projects. But I think all of us who have grown up with this problem have seen the baby grow into a child, and the child into a man without fully realizing the size of the project."

Money for Roads is Plentiful

This year, Mr. Hirst continued, the United States would have available for expenditure on roads $650,000,000. But, he said, the people had been supplying the money more quickly than they had been able to devise means of spending it to good advantage. Such a condition was in marked contrast to that of a few years ago, when "there was always a suspicion about young college 'dudes' coming out and telling grey-bearded old farmers how to handle the road work."

"I do not know whether the growth of the road movement in Canada has been the same as in the United States," he continued, "but I assume that human nature does not cease because of an imaginary boundary line, and that your progress has also suffered through the disease of politics." He explained that a political turnover in America had meant the refilling of all Government appointments, and that consequently the progress of roads had suffered, because about forty of their road superintendents were replaced every year. "And moreover," Mr. Hirst remarked, "the principal occupation of the new men was to spend their time telling what fools the men were who held office before them."

Cannot Complete System in 15 Years

Mr. Hirst said that from 1907 till 1911 the State Highways Department of Wisconsin was merely an Advisory Board, but that from 1911 on some 5,000 miles of road had been taken under the control of the State. "I am firmly convinced," he said, "that we can spend several million dollars in making these roads passable, not in 1950, but in 1920. There is no state, and there is no province in the Dominion of Canada that can produce men, money or material to fully complete the highway system they must have in the next ten or fifteen years.

"But pending this ten or fifteen years," he questioned, "are you going to be stuck in the mud, or are you going to first make your roads passable and leave as of secondary importance the making of them into the permanent highways that you would like to have?"

Patrol System Very Effective

Outlining Wisconsin's experience, Mr. Hirst stated that they had adopted the patrol system, by which one patrolman, with a team and wagon, was allotted to each six or ten miles of road under the maintenance scheme. These patrolmen, he stated, had been able to bring Wisconsin's roads up to such an improved condition that the average speed possible in traveling the full length of the state had been increased from 15 to 22 miles per hour, and general satisfaction had been given all around.

If he had four and a half millions to spend on maintenance, and twenty millions to spend on new construction, he stated, he would see that provision was made for the outlay of all the maintenance fund before he started on construction. The Wisconsin theory is—First make all the roads passable, then put in the permanent roads as rapidly as money, labor and material can be had. One dollar spent intelliently on maintenance, he declared, is worth two or three dollars spent on construction.

Gravel Roads Advocated

In the past two years Wisconsin has found that they could maintain their roads to a high state of efficiency at a rate of $400 per mile, whereas construction would cost anywhere from $30,000 to $50,000 per mile. Remarkably fine results, he added, have been reached with gravel roads, and, telling of his state's further experience, Mr. Hirst stated that the waterbound macadam road had given them endless trouble. As a result, they have now settled down to the policy of constructing three types of road—earth surfaces, sand on clay or clay on sand; gravel roads, constructed at a cost of $8,000 a mile; and concrete roads, or roads of other material on a concrete base. This latter, he stated, was the only ultimate road for heavy traffic, but the cost is high.

The gravel road was especially recommended by Mr. Hirst. Wisconsin's experience had proved it to be unbeatable for temporary work. Under the patrol system of maintenance it was giving the best of service. Mr. Hirst was opposed to the road drag as a maintenance implement, but recommended the road machine and planer with which his patrolmen were equipped.

A lively discussion followed Mr. Hirst's address and, in reply to many questions, he was able to give

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Capt. Lucius E. Allen is New President of Ontario Good Roads Association

Capt. L. E. Allen

much detailed information as to the construction of various types of roads to meet local needs.

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An interesting address was delivered at the final session on Friday morning by Lieut.-Col. W. G. MacKendrick, D.S.C., who made a reputation for himself at the front as a road builder. Col. MacKendrick gave a reminiscent talk of his experiments and difficulties in France with road gangs, and out of it he had some advice to offer to the heads of Ontario municipalities who may now be sharing in the programme of the Government. He pointed out that the two first essentials of road construction are drainage and maintenance. As a matter of fact, he believed maintenance should be placed first, and his suggestion was that it would be better to improve the existing roads and bring them up to a fair condition than it would be to start upon active construction. Drainage, he felt too little attention has been paid to this feature.

Mr. W. A. McLean, Deputy Minister of Highways, emphasized some of the points which had previously been drawn to the attention of the association. He insisted upon proper drainage, and regretted the fact that some districts have felt that when they built a ditch by the side of the road they had the impression that they were not making any showing for their expenditure. One of the worst slanders upon the macadam road, he stated, was due to lack of drainage, for even macadam roads could not stand up if they were constantly subjected to the seepage of water from underneath. He gave a number of examples of road construction where attention had not been paid to the first principle of economy, drainage, but he hoped the municipalities are now appreciating the value of this part of their work. He also advised that each district undertaking any progressive road policy should appoint a permanent superintendent, a man who would hold office even through the fluctuations of councils who have to be elected by the people. Touching upon the question of a municipality's liability for accidents on the highway, Mr. McLean recognized that there must be a certain amount of liability, but added that there is a stage beyond which no municipality should be held liable. If a district supplies a good road twenty feet wide, that should be enough for any man to drive on, and if a man, under those conditions, chose to drive in the ditch, then he should do it at his own expense.

Resolutions

The Association went on record as favoring a general scaling up in the fees now charged for automobile licenses. While the association did not state the extent to which they believed the fees should be advanced, the general feeling was that if the Government is going to produce better roads the motor owners should be willing to bear their share of the cost, and the association wanted the Government to know their views upon the point. They also passed a resolution approving the policy for good roads as outlined by Hon. F. C. Biggs, Minister of Public Works. The association also went on record as favoring the spreading of the cost of provincial roads over a whole county instead of limiting the expense to the township through which the road may pass. By this, it was felt that the costs of improved roads would be equalized over a whole county instead of leaving the expense to be borne by certain townships. Other resolutions favoring minor amendments in existing acts were carried.

The report of the nominating committee gave the following officers for 1920: Honorary presidents: K. W. McKay, St. Thomas; C. R. Wheelock, Orangeville; president, L. E. Allen, Belleville; 1st vice-president, T. J. Mahoney, Wentworth County; 2nd vice-president, W. H. Brown, Bruce County; secretary-treasurer, Hon. G. S. Henry; directors: F. A. Senecal, L'Original; T. J. Mahoney, Hamilton; John Currie, Strathroy; J. E. Jamieson, Southampton; W. H. Nugent, S. L. Squires, Toronto; T. L. Kennedy, Dixie; W. H. Pugsley, J. A. Sanderson, and J. E. Masters.

Ottawa Branch A.C.B.C.I. Dealing With Question of Wages

At the last general meeting of the Ottawa branch of the Association of Canadian Building and Construction Industries, held on February 18th, a very full report of the convention of the Provincial Builders' and Supply Association was presented by Messrs. G. A. Crain and H. J. Graham, the delegates representing the Ottawa Association at that convention.

At the present time the Ottawa Association is dealing with the question of wages for this year. Below is given a list of the rates of wages that are being asked by the different trades. The association is working on the principle of collective bargaining, and is dealing with the trades through the Building Trades Council of Ottawa, instead of dealing with each trade individually.

The Joint Industrial Council will also be continued as it has proved very advantageous, both to the men and to the employers.

The officers for the year 1920 of the Ottawa branch, A.C.B.C.I. are: President, G. B. Greene; vice-presidents, H. J. Graham (General Contractors' Section), J. R. Douglas, (Trade Contractors' Section), R. Hooper (Supply-Men's Section); honorary treasurer, E. M. Barrett; honorary secretary, G. A. Crain; Board of directors, W. Doran, W. A. Mattice, S. Christie, J. B. Duford, W. McInenly, E. D. Spence, H. Peel, E. Ramus, J. S. C. Adamson, J. R. Murphy, J. T. Blyth, A. K. Mills.

The following list gives the demands of the different trades in Ottawa for the year 1920:

	Per Hour
Masons and Bricklayers, Marble and Tile Setters	$1.00
Carpenters	.85
Laborers	.65
Electrical Workers	.85
Plasterers and Cement Finishers	.85
Wood, Wire and Metal Lathers	.75
Stone Cutters	1.00
Sheet Metal Workers	.85
Slate, Tile and Composition Roofers, Damp and Waterproof Workers	.70
Plumbers and Steamfitters (settled by themselves).	
Heat and Frost Insulators and Asbestos Workers	.65
(To be dealt with by Master Plumbers)	
Ironworkers—	
Laying out templates	.80
(Cutting main material; cutting main detail)	
Rivetting	.70
Punching, drilling, facing, sawing, grinding, chipping, bucking, heating, assembling	.65
Handling, straightening, scraping, painting, weighing, helping out, main material	.60
Blacksmiths and toolsmiths	.80
Engineers—	
Steam shovels and drag line	1.00
Steam shovel craneman and dinky engineer	.75
Orange peel buckets and clam shell	.75
Derricks and steam rollers and cableways	.75
Steam hoists	.75
Steam concrete mixers and air compressors	.70
Engineers not specified	.70

Montreal Builders Hold Annual Meeting

Stabilization of the Building Trade to be Considered—Association Takes Action on War Memorial—New Officers

At the annual meeting of the Association of Montreal Building and Construction Industries, held in Montreal on March 1st, the question of the stabilization of the building industry was discussed.

The report of the secretary-treasurer was submitted by Mr. David K. Trotter, who in his financial statement showed that, though the year had begun with liabilities of $500, there was now a surplus of $429, and the capital account had not been touched. Three years ago liabilities were $3,000, but that had been wiped out by a special fund raised in 1918 and by the influx of new members during the current year. There were now 158 members on the roll, an increase of 46 for the year. The need of more commodious premises was urged, and the secretary suggested that the exchange should erect and own its own building, with fully equipped restaurant, recreation and business rooms. This, he thought, might be made a paying proposition. Commenting on the work of the sections of the association, Mr. Trotter discussed the urgent need for arriving at some basis on which to deal with labour problems in relation to the building trade as a whole, under which different crafts would be uniformly balanced. The adoption of an apprenticeship system was also urged.

Mr. E. G. M. Cape, in moving adoption of the secretary-treasurer's report, said there were men who were now organizing the building trades for what would either be an adjustment or a strike in the very near future. For that reason there was need of a strong Builders' Exchange to-day.

Association Suggests Soldier's Memorial

On the motion of Mr. J. K. McNutt the following motion was unanimously accepted: "Whereas the matter of the erection of an appropriate Soldier's Memorial will attract the attention of the citizens of Montreal at a very early date, and whereas the form of memorial must only be decided after a great deal of consideration of the magnitude of the Great War, and the sacrifices and bereavements of our citizens, and whereas in our judgement we believe that the memorial should be in keeping with the importance that the city of Montreal has attained in the commercial world; be it resolved that the Builders' Exchange favors the erection of a memorial music hall that will not only meet the needs of our city for the next century, but will itself be a lasting monument erected to the memory of our sons slain in the defence of our Empire, and furthermore, we as a body, promise our unstinted support, morally and financially, to any representative body selected for the purpose of collecting the necessary funds to build, equip, and endow the same". Mr. J. P. Anglin seconded the motion, and Mr. W. H. Ramsay supported it. The mover and seconder were appointed a committee to follow up the proposal.

A report of the Committee on Labor at the Ottawa conference was made by Mr. J. P. Anglin, who read out the recommendations, which provided for

Three Members of New Directorate of Association of Montreal Building and Construction Industries

W. M. Irving, President

F. J. Parsons, Second Vice-President

J. E. Walsh, Hon. Treasurer

compulsory reference of disputes to the conciliation board, compulsory incorporation of labor organizations, the fixing of March 31st for termination of labor agreements, and other matters. The report was approved and referred to the Standing Committee on Labor. There was also some discussion on the apprenticeship system, and this was also referred to the committee.

Mr. Jas. K. McNutt, Third Vice-president of the Association of Montreal Building and Construction Industries

Stabilization of Building Industry

Mr. W. M. Irving, in his presidential address, referred to the great need for stabilizing the building trade, and the rather difficult problems which confronted any building operations. He spoke of the labor troubles of the past year as they affected the building trade, and stated they were not altogether clear to go ahead with an important building programme. The most important business that their association would have to take care of during the coming year, and that very early perhaps, would be the stabilization of the building trade. There were organizers in the Province of Quebec, not only from other parts of Canada, but from the United States, who were making a special effort to organize Quebec in such a way as to cause a demand for further increases in pay and curtailment of hours. The president alluded to what he had recently observed in England of the conditions there and emphasized the fact that labor leaders were now losing faith in the strike and were preferring the attainment of their objects by direct legislation. He suggested that perhaps this method might be tried in Canada, and that an earnest effort should be made to meet the men by amicable conferences.

In surveying the operations of the Builders' Exchange during the past year, the president referred to the Federal Government's housing scheme, in which connection they had nominated members to co-operate, but these names had not been taken advantage of. "The housing scheme has never materialized," said Mr. Irving, "and I doubt if there is a housing scheme in the City of Montreal to-day."

New Officers

Mr. W. M. Irving was re-elected president for the ensuing year, and the following other officers were elected without contest: First vice-president, K. D. Church; second vice-president, F. J. Parsons; third vice-president, Jas. K. McNutt; hon. secretary, John C. Watson; hon. treasurer, J. E. Walsh; directors: Messrs. W. C. Munn, J. P. Anglin, John Quinlan, C. M. Morssen, Douglas Bremner, T. Latourelle, J. H. Roberts, Fred B. Locker, A. W. Bremner, A. T. Alexander, Wm. McNally, J. M. G. Lockerby and John Grieve.

Should Engineers Unionize?—*A Debate*

Affirmative and Negative Sides of this Question Discussed in Two Papers Read Before Toronto Branch E. I. C.

Unionization of Engineers is Advisable, Practical and Necessary

by W. Snaith

SHOULD engineers unionize? It will serve to clarify the issue if we should, to some extent, say what we understand by the term "unionization". According to the new dictionary of the English language, a union is a combination of co-laborers for the joint and mutual protection of their specific trade; unionism is the principle of combining for unity of purpose and action; a labor union is an association of wage workers in a trade for advancing their mutual interests; a trade union is an organized association of workmen skilled in any trade or industrial occupation, formed for the protection and promotion of their common interests, especially the increase of wages, better condition, shorter hours of labor, mutual insurance. etc.

An engineer is defined in the Century dictionary as one versed in any branch of engineering; one who runs or manages an engine. Engineering is there defined as the science and art of making, building, or using engines and machines or of designing and constructing public works or the like, requiring special knowledge of materials, machinery and the laws of mechanics. These definitions are more or less general and it would not be too much to say that the Engineering Institute is a Union within the definition of a union as a combination of co-laborers for the joint and mutual protection of their specific trade, if we conceded that trade is not very much different from profession.

Unionization, I do not doubt, conveys to your minds, as it does to mine, a more definite idea than the general one I have mentioned, and for the purposes of this debate I think we shall agree, in order that there shall be a debate, that we mean what a labor leader would understand by unionization, i.e., a union of engineers for the joint and mutual protection of their profession and the promotion of their common interests, especially the increase of salaries, bettering of conditions, and to make the case more clear-cut, let us include the right of engineers to use unionism's final weapon in the securing of its demands—the right to strike.

Three Viewpoints of Unionization

Having cleared the way by the definitions my proposition is to prove to you that the engineering profession should be unionized and I should like to do this under three headings: That it is advisable; that it is practical, and that it is necessary.

Unionization is advisable because in the first place it binds together by strong ties, such as self-interest, co-operation and the like, and, in the second place, because in union there is strength.

It is practical because it has already produced results among engineers, and because it has produced results among other callings.

Unionization, in the third place, is necessary for four reasons:

1. Salaries are too low and can be raised.
2. Because the world needs engineers and is not likely to get them unless salaries are raised.
3. It is necessary, very necessary, because other agencies have failed.
4. Unionization has never failed in the long run.
5. Unionization is necessary because, as was said in the old "Tea Party" days: "If we do not hang together we shall hang separately."
6. It is necessary because it is founded on correct principles.

Let me now enlarge on these points:

Unionization is Advisable

As to the advisability of unionization, the statement that it binds by strong ties and that in union there is strength, calls for little in the way of proof, and it would be necessary to place before you a concrete proposal for the formation of a union, let us say, affiliated with the American Federation of Labor before it would be worth while to amplify this phase of the subject. We shall probably reap more benefit by proceeding to our other points.

Unionization is Practical

I have said that unionization has produced results among engineers and as proof I would submit that in the International Federation of Technical Engineers and Draughtsmen affiliated with the American Federation of Labor, there are over 4,000 civil, electrical, and mechanical engineers, besides some 3,000 naval architects, and a few thousand draughtsmen, all highly trained, technical men, graduated from almost every university in America. There are 39 unions, scattered over America from coast to coast. In the National Federation of Federal Employees, which is also affiliated with the American Federation of Labor, there are more than 5,000 civil, mechanical and mining engineers besides some 6,000 school teachers and 55,000 others, among whom are many professional men and women. The Chicago Union has grown to such a point that the architectural men in the union expect in 1920, to have the union label used on all plans and specifications, and they further expect to be backed up in this by the Building Trades Council, so that no union men will work from any but union label plans.

There may be some here who will almost instinctively oppose such an action, but the proposed legislation which this institute is apparently anxious to secure, is based on the same fundamental principle.

Unionization is practical because it has produced results among other callings. A classic example of this is the pay of bricklayers; but the locomotive engineers and firemen, together with the other great Brotherhoods, are a better example still, on account of the high tone which they have managed to give their organizations. I need not go into details in this connection. It is not pleasant reading for engineers to read the statement of salaries paid to the operating department of the railways and contrast it with that paid to engineers.

We have seen that unionization is advisable and practical, let me now show you that

Unionization is Necessary

1. Unionization is necessary because salaries are not only lower among engineers than among a number of trades, but they are actually and positively too low, regardless of what these trades may be getting. That salaries can be raised by unionization need only be stated to be adopted. It is, of course, assumed that engineers will stick together and work together. If they do not they have abandoned the principle of unionization and it cannot help them.

2. The world needs engineers at the present time and it needs them very much indeed. The world, however, is not going to get engineers, as such, unless it pays them better to be engineers than to be something else, and the world is offering engineers much greater rewards as salesmen and managers than it is as engineers and this not at all necessarily because their training fits them as salesmen or managers or such like, but for the simple reason that the world is accustomed to paying better salaries for these positions than it does to engineers.

3. Unionization is necessary because other agencies have failed. There is a stirring of the dry bones in a number of the National Engineering Societies of America, and the members longingly expect that this time something will be done. I cannot say that I think so. It was pointed out very aptly by a writer in an engineering journal that the type of man who is elected to office in these societies is not the type of man who can be expected to be very much interested in the salaries of the junior members of the profession. (And right here let me say that I have always considered that the salaries paid in the higher branches depend very much on those paid to the juniors in the profession).

Never Failed in the Long Run

4. Unionization has never failed in the long run. This is a strong statement, but it is abundantly justified. The Brotherhood of Locomotive Engineers has never lost a strike in its history and has not had a strike in twenty-five years or more. This record is probably not equalled by any other union. Unions are fallible and make mistakes and get beaten for them. It is not surprising that union leaders should make mistakes. They are not generally expected to be university men or men of great education, and the history of the labor union movement is such that it is not surprising if some of their leaders should go to extremes. It is a mistake to assume that because other unions have made mistakes in the past that a union of engineers would repeat such mistakes. If engineers unionize it will not be too much to expect that they will act in a gentlemanly and professional way. They have handled the powers of nature in the past in a way which has been creditable to the profes-

sion and it is not to be expected that when they secure the use of powers to which they are abundantly entitled and which will redound to their own advantage that they will not use these powers wisely.

5. Unionization is necessary because if we do not work together, we shall, as we have proved many times in the past, get nowhere.

6. Unionization is founded on correct fundamental principles. A practical proof of this exists in the fourth point which I have made before. Unionization has never failed in the long run.

I might preach a sermon under this head from the text "Ask and ye shall receive," and in that case I would particularly emphasize the word "ask". There is a vast difference between asking and begging. It is a different thing to ask knowing that your request will receive serious consideration because several hundreds, if not thousands, of others are asking for the same thing at the same time from what it is when you ask, knowing that you are asking for yourself alone.

Economists' Point of View

These particular arguments are valuable, but they are not as fundamental. perhaps, as following the reasoning of the political economists. The economists state that there is a fund from which labor and capital draw their resources. This fund is circumscribed to this extent, according to the economists, that if labor takes too much there will be nothing left for capital. Of course, on the other hand, if capital takes too much labor will starve and capital would for that reason be destroyed. Now, only two conditions are possible with regard to this fund. It is either ample to take care of the demands made upon it by both labor and capital, or it is not ample. If it is ample there is no question that engineers should receive their fair share. If wages have gone up the salaries of engineers should have gone up in the same proportion. I do not need to prove that they have not. Let us suppose, however, that the fund is not ample, that there is not enough wealth in this fund for everyone to get all that he would like. In this case I believe that more than ever the engineer should get his share first by reason of his education and ability. I never get to this point but I am reminded of Aesop's fable of the bat, which I should like to quote for the benefit of the engineer who feels that he should not be classed with labor. The mice asked the bat to be their king, and were turned down with a certain amount of indignation by the bat, who said that he was a bird, and to prove it, flew over to the birds. The birds laughed at him and assured him that he was not a bird. The bat flew back to the mice to be a king, but the mice had elected a king and would not have anything to do with the bat now. If the engineer feels that he is an ally of capital is it not possible that he may be giving up his position as king of labor?

Conclusion

I have tried to show you in what I have said that unionization is advisable, practical and necessary. There are many minor points which I have not touched on at all; probably the first objection that anyone makes to the subject of unionization is that it is not professional, or that it would lower the dignity of the profession. Over 15,000 engineers who already belong to unions disagree with this stand, and I can not find it consistent myself with the definitions which the new dictionary of the English language gives of the words profession and dignity. Profession is an occupation that properly involves a liberal education or its equivalent and mental rather than manual labor; hence any calling or occupation involving special mental and other attainments or special discipline. Dignity is defined as grave or noble bearing, impressiveness of manner or character, repose, and serenity of demeanour, the state or quality of being excellent, worthy or honorable. I believe that an engineer in a union can be as impressive of manner or character as the best engineer outside of a union, and I think the unionized engineer would be equally excellent, worthy or honorable.

I believe that the profession of engineering after unionization would still involve a liberal education, or its equivalent and mental rather than manual labor, and that it would still call for special mental and other attainments or special discipline. In other words, I do not believe that the dignity of the profession would be harmed in any way.

I would like to go further and state that the dignity of the profession would be materially enhanced if engineers could be placed in the position that they could afford to devote some of their time and energies to matters outside of their calling.

I would not like anyone to get the idea that the principle of unionization can be adopted without a struggle and without individual loss and suffering. I have no doubt whatever that this would happen in some cases. I am satisfied that it would not happen to anything like the extent that it happened in the earlier days of the labor movement, and still happens in certain sections where labor is struggling for a foothold. Unionization does not offer you something which is easy and perhaps for that reason it will attract you.

Betterment of Profession Attainable Without Unionization—by Prof. P. Gillespie[*]

THE value of those whose interests are more or less identical of having some form of organization for mutual advantage and for collective and individual protection is generally conceded. The slogan "each for all and all for each" has exerted a powerful influence on men from the earliest times. And moreover, this disposition is entirely defensible and worthy of the support and encouragement of fair minded men. Workmen have formed trade unions—local, national and international. Experience has taught them that while the voice of a single worker is seldom heard in the din of modern industrialism, the united demand of a thousand is recorded a respectful hearing. Hence the attempt on the part of labor to lay down conditions under which its members may be employed, its attempts to stipulate the minimum wage its employer must pay, its efforts to fix the number of hours that shall constitute a day's work and finally its refusal, often successfully enforced, to work with men not of their affiliation or to handle goods or material produced by workmen not similarly unionized. This last attempt at control is an illustration of the desire of labor to improve its solidarity and to extend its power through the organization of national bodies where craft distinctions are not recognized. These are attempts to unite all workmen irrespective of occupation under one banner, so strong, so thoroughly loyal and so alert to the interests of its members that no employer or group of employers will be able to refuse its demands, or successfully oppose it. To enforce its demands it has recourse to the strike, local, general and sympathetic, in which latter case men who have no grievance themselves are called out in order that the demands of the members of another craft in another locality may be assisted in securing whatever concessions they may for the time being require.

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Employers' Associations

Then again there are Associations of Manufacturers, Employers' Associations, Councils for Industrial Defense and what not, the objects of which are to resist what are thought to be the unreasonable demands of the labor unions and to defend themselves against their untrustworthiness and legal irresponsibility. These have advocated the placing of full legal accountability upon labor unions so that duties and responsibilities as between employers and workers might be reciprocal and equal. Generally they have been opposed to strikes and lockouts and in favor of an amicable and equitable adjustment of differences with employees which will preserve the rights of both parties. By injunction they have fought the boycott and through representations to legislatures they have opposed vigorously its legalizing. They have sought, generally by lawful means, to aid the regularly constituted officials and machinery of the state in the enforcement of existing laws and the punishment of law breakers.

Thirdly and finally there are the so-called professions, a profession being generally understood to be an occupation involving a liberal education or its equivalent, and mental rather than manual labor. The professions too have their associations for professional advancement and for individual and collective protection. One function is the dissemination of professional knowledge. Another is the control of the educational qualifications of their members and the admission to their ranks. They discipline their members for breaches of professional ethics and etiquette and unprofessional or immoral conduct. They have a code of ethics and keep a tariff of fees for professional services which can usually be collected in the courts of law. They are recognized by statute in that there are certain services which by law must be performed by members of these professions and by them alone. They seldom or never resort to the strike. To the professional man the strike is undignified, unethical and unnecessary.

The Strike is the Weapon of the Trade Unions

The so-called learned professions have always been held in high esteem individually and collectively in civilized communities and this for several reasons. They are usually men of attainments and culture; as a class they identify themselves with the life of the community in which they dwell. They are usually men of exemplary character and conduct and while in many cases their fees are large, there are many instances in which members of the professions have rendered valuable professional services for individuals and communities for which no remuneration was received and none was expected. Between the trade union and the profession there are then resemblances and differences. Each endeavors to promote the social and material interests of its members. Each controls or endeavors to control the admission to its ranks and to fix in some degree the rewards which the services of its members can command. The trade union must command support by more or less autocratic measures. When disputes arise regarding hours of labor, working conditions or wages which do not seem capable of settlement by negotiation, the union has recourse to the strike to force the concession it demands. But strikes cannot be made effective if other men are permitted to take up the tools laid down by the strikers and a strike involves picketing, persuasion, intimidation and often violence. To force the "unfair" employer to see the error of his way, the boycott is adopted whereby his shop and its product are declared to the world to be unfair and are to be shunned by all friends of labor. In certain cases the strikers resort to sabotage, or that species of direct action where expense and trouble are made for the employer in order to force his hand.

Engineering is an occupation requiring on the part of those who practice it, more than an ordinary amount of intelligence. It is an occupation in which the empirical gives place to the analytical to a much greater extent than in many lines of human endeavor. On the products of its work, the lives and fortunes of humanity depend. It boasts great traditions. It has tunneled the mountains, bored beneath the sea, conquered the air, made the desert to blossom as the rose. With the work of Watt, Stephenson, Smeaton, Roebling and Baker constituting the background of its history, the engineering profession has a record for achievement surpassed by no other. And with the increasing number of new applications of technology to the carrying out of the world's work, no profession has a future of greater usefulness.

It is a truism that engineers have not been accorded the recognition to which their work entitled them nor have their emoluments in general been commensurate with the service they render. Like Kipling's immortals their reward too often is the joy of the working and with Berton Braley, they can say:—

Though we like our share of treasure and the pleasure that it brings.
It is something else that drives us to our goal,
It's the triumph of our labor over elemental things
And the vision which gives splendor to the whole.
We are members of an order that is guided on by dreams
By the voices of the prophets and the seers,
And unless you care for service more than money getting schemes
You had better never join the engineers.

Results of Union

Being human, engineers naturally aspire to a few of the better things of life. To attain them some have proposed unionization; others, that they seek incorporation so as to acquire the legal status of other professions. The results of unionizing would probably be these—

There would be a minimum scale of pay. A day's work in hours and in output would be defined and the closed shop would follow.

The unionized engineer must support his union otherwise his union ceases to function for who among engineers would support a union that could not conserve for its members, the work and the pay that are available? He must therefore refuse to work along with non-union men; indeed he must either coerce them into joining his union or he must eliminate them altogether. All engineering offices must therefore be closed to the non-union man. The unionized engineer further must boycott all equipment, structures or plant tainted by non-unionism. The chief engineer of the H.E.P.C., for example, could not recommend to his Commission the acceptance of tenders for turbines, motors, transformers or transmission towers upon which non-union engineers had been employed. The chief engineer of the Department of Railways and Canals would refuse to consider tenders for bridges unless the designs were by unionized engineers. If this seems fanciful, just reflect that any union that does not embrace the great body of the craft workers must fail of its purpose. The necessary means to this end are the closed shop and the boycott. And to these a very large number of engineers who object to unionizing on principle, and most of the employers are opposed. It would be intolerable, to free men everywhere. Government departments and Government Commissions, both large employers of engineers, would have both the power and desire to fight it, and they would. It would be bound to fail.

Finally, how would one reconcile the coercive methods of the union with that fine sentiment appearing monthly on the front page of the Institute's Journal which asserts that the function of our Society is "to develop and maintain higher standards in the engineering profession and to enhance the usefulness of the profession to the public". Or how could one square it with the definition of the illustrious Treadgold that engineering is the adaption of the great forces in nature to the use and convenience of man?

Let us consider what the effect on the average citizen would be if he learned that the physicians or the clergymen or the editors of his community had become unionized and had adopted the tactics of unions. Would he feel that they had exalted their callings? Could he bring himself to believe that such a step would be consistent with the professions of men who shape to some extent the intellectual well-being of a community? I am afraid he could not. And similarly for engineers, unionization would be a fatal blunder.

Can Secure Legal Protection

But another and better way lies before. Engineering may become a profession since it is unwise to become a trade. Engineers might have had legal protection ere this had they been less silent. And I believe they can get it to-day if they go after it in the right way. With hundreds of educated bright and capable men in its ranks, with men of vision and capacity among its members, with a record for fine service in the past and an outlook for greater usefulness in the future, no government will refuse to grant to engineers what it has already granted to physicians, lawyers and dentists. Chartered accountants have acquired a measure of legal status where a few years previously they had none, simply by concerted articulate team action. Dentists whose occupation is manual and mechanical to a very large degree have obtained the professional status because they presented their case to a public that was open to reason and was prepared to act once it was convinced. As engineers are we willing to become a trades union where we might be a profession? Are we willing to sacrifice our birthright for a mess of pottage? Are we going to grasp the shadow when we might have the substance?

Objections to Unionization

I am opposed to the unionizing of engineers:—

(1) Because I believe it would be impossible to get more than half the available membership to support unionization.

(2) That being the case, in order that the advantages of unionization may accrue to the unionized membership it will be necessary to enforce the closed shop.

(3) The strike and sympathetic strike are means of coercion which we as engineers cannot entertain. It is entirely possible that because of dissatisfaction in one section of the country, all engineers regardless of classification or locality would be called out, although they might have no grievance of their own. And just here let it be stated that nothing has alienated public sympathy from labor unions in the past quite as much as the sympathetic strike.

(4) Another sequel to this will be that unionized engineers must refuse to recommend or instal any appliances upon which non-union engineers have been employed.

(5) The engineers of Canada now have in the Engineering Institute of Canada and in other allied associations everything that they might hope to secure by unionization except whatever might accrue through the strike as a weapon.

(6) By unionizing engineers we are prostituting an ancient, honorable and respected calling to the level of a trade. By endorsing the coercive method we are accepting the creed that between those who perform expert service and those who profit thereby, there is inevitable warfare, and that an appreciative public opinion does not exist. This in my opinion is not borne out by the facts

(7) We would be ignoring the principle that interests of the general public are greater than those of either employer or employee.

(8) I believe that legal protection for engineers in Ontario is attainable, for I refuse to believe that from a Government that grants protection to dentists and veterinary surgeons, that taxes the consumer in order to bonus a desirable industry, that refuses to tolerate the unqualified teacher in the humblest of our rural schools, the protection of professional engineers can be obtained. Further, that if it is not obtained, the fault will be ours, not that of the public or the public's accredited representatives.

(9) I believe that the use of a crude weapon is usually an acknowledgment that the user cannot command a finer one. I believe that to unionize engineers would be to declare to the world that we as a class possess nothing that is distinctive or worthy in education, training, attainments, traditions or capacity for altruistic endeavor.

(10) While neither the unionizing nor the professionalizing of engineers will ensure work where work is not to be had, nor fees where consulting services are not required, I believe that the latter will secure everything that the former will obtain and with infinitely greater credit to engineers as a class, and with their almost unanimous approval.

No. 9

Canada's Contractors—W. Hicklin

At last week's Conference on Road Construction, the consensus of opinion was that mechanical haulage for road materials was the most satisfactory method that could be adopted for extensive road construction. In the discussion on this topic, some very favorable references were made in this connection to a long stretch of road built last year for Haldimand County, Ontario, this highway, amounting to 14 miles in length, being built by contractors who were wise enough to select motor truck haulage for the transport of their road materials. The firm which did this work was MacConnell & Hicklin, contractors, of Ottawa and Toronto, the latter member of which firm is the subject of our sketch this week.

Mr. Hicklin was born in Belfast, Ireland, in 1876, After receiving his education at Mercantile College, Belfast, he was articled with a leading consulting civil engineer in that city for five years. He was then employed as resident engineer on various work in the neighborhood of Belfast, comprising waterworks and roadways. Mr. Hicklin then served three years in Africa as location and construction engineer on a railway between Zambezi and Lake Nyassa. From 1906 to 1912 he was resident engineer of the Canadian Northern Railway and superintendent of construction on the A. Q. & W. Railroad. Later he contracted for concrete work on the Quebec & Saguenay and on the C. P. R. in the Eastern townships and on the north shore of Lake Superior.

During the war he was engaged on munition work in Massachusetts, Sault Ste. Marie and Toronto district. Early in the spring of 1918 Mr. Hicklin entered into partnership with Major H. B. MacConnell, of Ottawa, specializing on road building. This firm shortly afterwards signed up 14 miles of highway for the county of Haldimand, which work was successfully finished last year. They have now secured a contract in the same township for another 22½ miles of road of the same type.

Mr. W. Hicklin

Mr. Hicklin is an associate member of the Engineering Institute of Canada.

Committee on Water and Water Powers Presents Report

(Continued from page 215)

This rapid progress reflects a great deal of credit on the Dominion and should be encouraged in every rational manner. At the same time it should be most carefully guided. One of the questions suggested by this prosperous condition is, how long will we be able to carry it on?

According to a recent statement based on United States official figures, the electrical installations in that country have doubled every five years during the past generation. In Canada the growth of hydro-electric development has been almost as spectacular, the present installation being over ten times that of 1900. The present hydraulic installation in the Dominion has nearly reached 2,400,000 h.p., and even if we assume only half the rate above mentioned for the United States, or in other words, that our present installation would double every ten years, a total of 4,800,000 h.p. would be reached in ten years, 9,600,000 h.p. in 20 years and 19,200,000 h.p. in thirty years.

Water-Power Resources of the Dominion

The following table shows the estimated developed and undeveloped water-power in Canada, an attempt being made at separating the available sites within the populated areas from those farther north.

Developed and Undeveloped Water Power in Canada

Province or District	Estimated Total Possible h.p.*	Estimated Possible in Populated area, h.p.*	Total Developed h.p.	Available in Populated area h.p.*
Quebec	6,000,000†	3,500,000	900,000	2,800,000
Ontario	5,800,000	3,800,000	1,000,000	2,600,000
British Columbia	3,000,000	1,300,000	310,000	990,000
Manitoba	2,797,000	597,000	78,600	518,400
Alberta	462,000	106,000	32,500	73,500
New Brunswick	300,000	300,000	17,000	283,000
Saskatchewan	220,000	62,000	40	61,960
Nova Scotia	100,000	100,000	30,000	70,000
Yukon	100,000	13,400‡	13,400	.....‡
Northwest Ter.	50,000	......	......	......
Prince Edw. Isl.	3,000	3,000	1,700	1,300
Total	18,832,000	9,781,400	2,383,240	7,398,160

*Minimum all year power, with possible regulated flow where investigated. Figures for some of the rivers included may vary as additional information is secured from future detailed surveys, flow records and conservation storage investigations.

†Not including Ungava. 5,000,000 h.p. south of the 50th parallel.

‡Available possibilities not definitely known.

We thus see that while our northern water-powers are yet untapped, there remains an aggregate of less than 7,400,000 h.p. within our populated areas. It may be added that this is by no means based on conservative estimates; full diversion and the greatest head possible at Niagara have been assumed and full regulated flow has been taken on rivers where conservation reservoirs are actually being utilized or where estimates have been made of such possibilities.

Mainly Constructional

East and West—From Coast to Coast

Permits to the value of $218,775 were issued by the Building Inspection Department at Hamilton during February last.

Building figures for York Township, Ont., for the month of February last were $222,600, an increase of $98,100 over the same month last year.

Building permits issued at St. Thomas, Ont., for the first two months of the year total more than $1,200,000, almost 200 per cent. greater than for the similar period of last year.

A recent report from Windsor, Ont., states that the contractors of that city will meet the demands of the bricklayers for $1.25 an hour; this rate, however, to remain stationary for the balance of the present year.

A recent report states that large financial interests in the United States will form a Canadian company to be known as the Imperial Brick Company of Canada, who will locate plants at Montreal, Toronto and Winnipeg.

In a recent report of City Engineer Adams, of Chatham, Ont., to the Water Commission, he recommends that a rapid sand gravity plant be built to solve the city's water problem. He estimates the cost of this plant at $336,000.

Toronto's total in building permits issued during February last was $1,463,775, compared with $676,185, for the same month last year. Last month's figure was very close to the record February total of $1,500,000 in 1912.

The Poole Construction Co., of Regina, Sask., recently moved into their new building at the corner of Hamilton St. and Eighth Ave. The building is of modern construction, 50 x 125 ft., providing ample room for office and warehouse purposes.

It is reported that the Dominion Government will take over the Edmonton, Dunvegan & British Columbia Railway, which connects the Peace River district with Edmonton. Mr. J. D. McArthur, well-known Winnipeg contractor, is the present owner of the road.

Work of moving and demolishing the present structures on the Indian Reserve at Sarnia, Ont., has been commenced to make way for the construction of the $3,000,000 Canadian plant of the Wills Lee Auto Corporation. This site was purchased from the Sarnia Indians last fall.

At a recent meeting of the town council of Aylmer, Ont., it was decided to adopt the government's housing scheme, and the following commission was appointed: Mayor Wagner, Jos. Davis and Thos. Wooster. The commission will ask for $40,000 for house building purposes this year.

Workmen of the various building trades in Toronto are seeking increases averaging 27 per cent. over the wage schedule decided on last year. Settlements have been arrived at in some cases, the bricklayers compromising on 90c an hour till April 1, and after that $1.00; electrical workers are receiving 85c at the present time and will get 87½c after April 1, and negotiations are under way between the various other trades and the Builders' Exchange.

The Housing Commission of London, Ont., will shortly call tenders for the construction of 54 houses, varying in design, forty-two of which will be constructed on the Pine Lawn site on the Hamilton road, and the remainder in the vicinity of the McCormick Manufacturing Company's factory.

A large deputation of citizens from Victoria and Peterboro Counties, Ont., waited upon the Minister of Public Works, at Ottawa, recently, to urge the replacing of the present bridge over Pigeon Lake, claiming the present structure to be unsafe for traffic. It is estimated that a new bridge at this point would cost in the neighborhood of $100,000. The Minister promised that Department engineers would be sent to Pigeon Lake to look over the situation.

The following officers were elected at the annual meeting of the Association of Montreal Building and Construction Industries: Pres., W. M. Irving (re-elected); first vice-pres., K. D. Church; second vice-president, F. J. Parsons; third vice-president, Jas. K. McNutt; hon. secretary, John C. Watson; hon. treasurer, J. E. Walsh. Directors—W. C. Munn, J. P. Anglin, John Quinlan, C. M. Morssen, Douglas Bremner, T. Latourelle, J. H. Roberts, Fred B. Locker, A. W. Bremner, A. T. Alexander, Wm. McNally, J. M. G. Lockerby and John Grieve.

Trade Incorporations

The Eastern Stevedoring & General Contracting Co., with head office at Quebec, P.Q., capital $100,000.

Bishopric Manufacturing Company, Limited, with head office in Ottawa, capital $150,000, to deal in wall board and building materials.

The Canadian Self Locking Concrete Wall Co., Ltd., with head office at Victoria, B.C., capital $5000,00 to carry on the business of contractors and builders.

Personal

Mr. C. C. Sutherland has been appointed assistant city engineer at Edmonton.

Mr. M. E. Crouch, of Sudbury, Ont., has been appointed resident engineer at Paris, Ont., and will commence his duties on April 1.

Mr. C. A. Boulton, B.Sc., of Galt, Ont., has accepted a position on the staff of E. G. M. Cape and Co., Ltd., engineers and contractors, of Montreal. Mr. Boulton has been engaged for the past two years in municipal engineering work in the province of Saskatchewan. He is at present working on one of the company's undertakings at Sherbrooke, Que., in the capacity of assistant engineer.

The resignation of Dr. Emile Nadeau, as Provincial Director of Housing, Quebec, which was tendered the government on January 9 last, was only made public recently. Mr. Oscar Morrin, Deputy Minister for Municipal Affairs, was appointed to the vacancy. The technical commission, composed of an architect, a town planner, and a sanitary engineer, appointed under Dr. Nadeau, has been abolished by the government, and each municipality will now be permitted to administer its share of the housing loan.

Obituary

Mr. M. J. Stack, a prominent Montreal contractor, died in that city recently from penumonia.

Mr. J. L. Douglas, city waterworks superintendent, North Vancouver, B.C., died recently following an attack of influenza.

Mr. Reid Munro, engineer, of Peterboro, Ont., died recently following an attack of influenza. Mr. Munro was an active member of the Peterboro Branch of the Engineering Institute of Canada.

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks, Sewerage and Roadways

Amherstburg, Ont.
Town contemplates construction of trunk sewer. Mayor, Mr. Park. Plans will be prepared.

Aylmer, Que.
Town has under consideration the construction of water purification plant costing $30,000. Mayor, Mr. Therian.

Dundas, Ont.
Public Utilities Commission plan to construct waterworks extension costing $48,000 by day labor. By-law will be submitted. Chairman, Wm. Mount.

Englehart, Ont.
Town wants prices on 8 in.-10 in.-12 in. sewer pipe and connections, 4 in.-6 in. cast iron water mains and fittings, wooden water pipe. Clerk, Jas. Paterson.

Hawkesbury, Ont.
Town plans to construct watermains and sewers to new flour mill. Chairman, Councillor Bellefeuille. C. N. Rly., will build siding into mill.

Hensall, Ont.
Usborne Township contemplates construction of drainage system and will have plans prepared. Clerk, Henry Strang, Hensall.

Hull, Que.
City contemplates construction of filtration plant to cost $250,000. Mayor, Mr. Cousineau.

Islington, Ont.
E. A. James Co., Engineers, Excelsior Life Bldg., Toronto, have submitted to Etobicoke Township Council report on new waterworks system costing $85,000. Clerk, Stephen Barratt, Islington, Ont.

Lacadie, Que.
Chs. Larocque, secy.-treas. to Municipality, has plans and receives tenders until March 15th for macadamizing four miles of road.

Leamington, Ont.
Town plans to lay 2,500 ft. of 4 in., 6 in. and 8 in. water mains. Clerk, E. C. Awrey.

Port Dover, Ont.
E. A. James Co., 36 Toronto St., Toronto, will prepare plans for sewerage system for Village and will call tenders for necessary material for waterworks system.

Shawinigan Falls, Que.
By-law passed authorizing City Council to expend $60,000 on aqueduct and street improvements, $50,000 on sewers and $101,600 on concrete pavements. Clerk, J. E. Meunier.

St. Eloi, Que.
Town contemplates construction of concrete sidewalk. Clerk, Jos. April.

St. Jerome De Matane, Que.
J. A. Gagnon, secy.-treas. for Municipality, receives tenders until March 23rd for supply of materials to be used in construction of water works and sewers. Materials must arrive before June 1st. Plans with secy.-treas. and with engineer, J. F. Grenon, Chicoutimi.

St. Louis Nazaire, Que.
Joseph Villeneuve, secy.-treas. for Municipality, St. Louis Nazaire, receives tenders for gravelling road in Township of Tache.

Ste. Marguerite De Blairfindie, Que.
Plans are prepared and tenders will be called for macadam road, two miles, for Municipality. Secy.-treas., Charles Larocque, Lacadie, Que.

St. Mary's, Ont.
Water Commissioners plan to extend water mains on Water St. S. Mayor, Mr. Brandon.

St. Thomas, Ont.
City contemplates construction of asphalt paving plant and is securing estimates. Prices wanted on $7,000 worth of crushed stone, also on road oil in quantities. Clerk, W. B. Doherty.

Sturgeon Creek, Man.
Municipality of Assiniboia contemplates expenditure of $25,000 on road work. Clerk, Frank Ness, Sturgeon Creek.

Toronto, Ont.
The Provincial Dept. of Public Highways has announced that approximately 1827.7 miles of roads will be constructed in Ontario this year. Minister, Hon. F. C. Biggs, Parliament Bldgs., Toronto.

Winnipeg, Man.
City will call tenders shortly for construction of pavements on various streets at an estimated cost of $334,712, and for construction of granolithic walks at an estimated cost of $111,742. Clerk, C. J. Brown.

City will call tenders soon for sewer costing $13,068. Clerk, C. J. Brown.

Woodstock, Ont.
John Morrison, city clerk, receives tenders until March 24th for construction of approximately two miles of trunk sewer and also for construction of 1,500,000 gallon sewage disposal plant. Plans with city engineer, F. J. Ure.

CONTRACTS AWARDED

Aylmer, Que.
N. Buccianelli, Hull, Que., has general contract for gravelling road at a cost of $159,605 for Hull South Township; secy.-treas., W. H. Stewart, Aylmer, Que.

Cayuga, Ont.
MacConnell & Hicklin, 171 Sherwood Ave., have general contract for roads costing $482,850 for Haldimand County Council. Length of roads, 22½ miles.

South Hull, Que.
M. Buccarelli, Chapleau, Ont., has general contract for road costing $159,600 for Municipality.

Windsor, Ont.
Border Cities Constructing Co., 81 Gas Bldg., will carry out all work in connection with the construction of intercepting sewer for Essex Border Utilities Commission, 66 Ouellette Ave.

Railroads, Bridges and Wharves

Hawkesbury, Ont.
C. N. Rly., head office, Toronto, plan to rebuild bridge here. Chief engineer, A. F. Stewart, 21 Wellington E., Toronto.

Montreal, Que.
Montreal Tramways Co., 78 Craig St. W., contemplate extension of their street railway system this year. General manager, J. E. Hutcheson.

Shannonville, Ont.
W. A. McLean, Deputy Minister for Provincial Dept. Public Highways, Parl. Bldgs., Toronto, receives tenders until noon March 26th for supply, erection and field painting of steel superstructure of 80 ft. steel bridge. Plans at office of Deputy Minister.

Sober Island, N. S.
R. C. Desrochers, secy. for Dominion Dept. Public Works, Ottawa, receives tenders until noon March 23rd for extension to wharf. Plans at Dept., Ottawa, Ont., at office of District Engineer, Halifax, N. S., and at P. O., Sober Island, N. S.

Toronto, Ont.
Toronto & York Roads Commission receives tenders for four miles of water bound macadam, three miles of bituminout concrete and two miles of bituminous macadam. Engineers, E. A. James Co., Toronto.

Victoria, B. C.
Strauss Bridge Co. of Chicago, U.S.A., are preparing plans for bridge costing $300,000 for City, C. P. Rly. and Provincial Govt. Address clerk, Mr. Bradley.

CONTRACTS AWARDED

Calgary, Alta.
Fegles Co., Fort William, Ont., have general contract for bridge costing $207,000 for City.

Montreal, Que.
Sub station costing $75,000 for Montreal Tramways Co., 78 Craig St. W.: General contract, masonry and carpentry, F. A. Grothe, 6 Cuthbert St.; foundations, Raymond Concrete Pile Co., 10 Cathcart St.

Ontario, Province Of
Canadian Des Moines Steel Co., Chatham, Ont., have contract for steel tanks, 100,000 imperial gals capacity, to be constructed at Raith, Upsala, Eagle River and Dyment, Ont., and 60,000 imperial gallon steel tanks for Fort William, Ont.

ESTABLISHED 1886

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Encourage Professional Practice in Town Planning

ONE of the most important government departments is the Town Planning Branch of the Commission of Conservation. Its importance does not lie so much in its past accomplishments—for only the beginning of its influence has been felt—as in the possibilities and developments which are in prospect. True, of course, some very tangible results have been noted during the few years' existence of the branch, but these are small in comparison with what can be and will be accomplished in the future. The principles of town planning are being firmly established, and the propaganda of the town planning branch is serving to put these principles into practice from Atlantic to Pacific.

The town planning branch has a big work ahead of it—a work that covers many spheres of activity that are constantly being widened. The exact nature of this work can perhaps best be gauged from a perusal of the report on page 172 of the Contract Record of Feb. 25. Suffice it to say that after a reading of the article referred to, one cannot help but notice the demands that are made upon this department and the importance of it as a factor in our economic welfare.

One point, however, that deserves emphasis is referred to in the closing sentence of the report: "It is also desirable to encourage professional practice in town planning so as to gradually build up a skilled profession in the country, capable of coping with the immense problems and numerous schemes in the future." This suggests a new calling for engineers and a calling too that bespeaks, as much as any other, service to their fellowmen. The community life really determines the national life and if the homes composing our communities and the communities themselves are planned according to the highest standards, we cannot help but place our nation's life on a higher plane.

The value of the principles of town planning and their effect on the life of people cannot be gainsaid. However, the appreciation and administration of these principles requires the services of a profession capable of dealing with the immense problems involved and of handling the schemes that will face us in the future. For this reason we should encourage professional practice in town planning so that our future town developments will be designed in accordance with the ideas which we all agree are essential to national efficiency.

Activities of Water Powers Committee of Commission of Conservation

IN last week's issue, a portion of the report of the Committee on Water and Water Powers of the Commission of Conservation was published. It dealt only with the water power situation in Canada, but this Committee has not limited its activities to this specific field, but has given attention to other allied subjects. Its report in this connection follows:

Among other work to which your Committee have devoted attention during the past year may be mentioned such subjects as aluminium and its use in electric energy transmission, water-power in Alberta, long distance electric transmission lines, the nitrogen industry and Canadian water-powers, on each of which comprehensive reports were prepared. Other investigations and reports include the power used in Canada and the United States, power required in pulp mills, government conservation storage, electric supply for Southern Saskatchewan, effect of tributary storage on Lake Superior level, while numerous answers were sent on request solving other particular problems of local interest in various portions of Canada.

Your Committee has also recently initiated an investigation covering certain features, facilities and obstacles in the operation of water-power developments with the object of promoting a fuller and more beneficial utilization of our hydraulic resources. In this connection particular attention is given to Canadian problems such as ice troubles and conservation storage. It is intended to spread this information for the benefit of those facing such problems and thus encourage a greater and more efficient use of our water-powers. A number of requests elicited by our own request for the information in this connection have already been received from power users asking how certain difficulties are solved elsewhere.

Another subject requiring attention is suggested by the number of requests for up-to-date information on developed and undeveloped water powers in various portions of Canada. For Eastern Canada our report of 1911 is the only one thus far published covering the ground in a detailed and thorough manner, but as both exploratory surveys, stream flow, measurement and other cognate work have been carried out since, and on the other hand a number of water-power developments have been completed, the tabular matter of our 1911 report requires to be brought up to date.

Among other future work may also be mentioned the collecting and co-ordinating of available stream flow and water level data and the investigation of possible more adequate supply of electric energy in certain portions of the Dominion.

Building Trades in Toronto Seeking Large Increases in Wages

ALL-round wage increases are sought by the various classes of building trades' workmen in the schedules which the Building Trades Council has been discussing with the Toronto Builders' Exchange.

The following list indicates the rate paid under the last agreement effected, the new rate sought, and the extent of the increase asked:

	Present Rate	Rate sought	Increase	Per cent.
Bricklayers...	$0.85	$1.00	$0.15	17.6
Carpenters	0.75	1.00	0.25	33.3
Painters	0.65	0.90	0.25	38.5
Elec. Workers.	0.75	0.87½	0.12½	16.6
Metal Workers	0.65	0.90	0.25	38.5
Iron Workers	0.65	1.00	0.35	53.8
Cement Fshrs.	0.65	0.75	0.10	15.4
Plasterers	0.75	1.00	0.25	33.3
Bldrs. Laborers	0.55	0.75	0.20	36.4
Elev. Workers	0.60	0.75	0.15	25.0
Stonemasons	0.85	1.00	0.15	17.6
Hoisting Engrs.	0.65	0.75	0.10	15.4

Bricklayers are actually receiving 90 cents per hour and will receive $1.00 per hour on April 1st. This also applies in the case of the stone masons. Carpenters, although their last agreement provided 75 cents per hour, are actually receiving considerably in excess of this rate from the employers, and expect to conclude negotiations this week for the $1 rate.

Painters submitted a schedule to the employers asking for 75 cents per hour, an increase of 10 cents on the existing scale, but demanded a closed shop agreement. This latter was refused by the employers with the result that the wage demand was increased to 90 cents per hour.

Sheet metal workers have been offered 75 cents per hour, but have rejected the offer.

Hoisting engineers are paid from 65 to 90 cents per hour, according to the machines they operate.

Elevator constructors have been definitely offered their 75 cent request, but the employers have not assented to other working conditions provided in the agreement.

Electrical workers have signed their agreement, which gives them 85 cents per hour at present, with a further increase to 87½ cents per hour on April 1st.

Harmony has so far attended the conferences between the individual unions and the employers, with the exception of the case of the Structural Iron Workers. The dispute in this case is rapidly assuming serious proportions.

Mr. David Davidge, secretary of the Builders' Exchange, in commenting upon the terms of the various schedules declares that recognition has not been extended to either the Structural Iron Workers or the Builders' Laborers, as neither is representative of the workmen in the respective crafts or trades. Furthermore, he declares that the labor unions may not call a sympathetic strike for any cause without first asking for a board of arbitration, and then referring the dispute to the Joint Industrial Council.

Toronto Painters and Decorators Consider Open Price Plan of Tendering

THE Toronto Association of Master House Painters & Decorators hold semi-monthly meetings to get acquainted and discuss matters of interest to the trade. Generally, also, after the business has been disposed of there is time enough left for a friendly game. About every other meeting they get around at 6 o'clock and have supper together, and on these evenings generally have a speaker address them on some timely topic. At their meeting on Thursday evening, March 11, the Open Price Plan of exchanging bids was under discussion. Mr. James Phinnemore was in the chair. The president of the association is Mr. Stewart N. Hughes; first vice-president, Mr. J. O. Dougall; second vice-president, Mr. W. W. Bamlett; secretary-treasurer, Jas. B. Thomson; auditors, F. H. McCausland and Jas. Kitchener. The executive board consists of A. E. Phillips, J. Stewart, J.P., R. Dale, Robt. Wood, E. W. Vernon, T. Aldrich, R. Jones, J. I. Rowles, C. W. Landon, M. Watson. Musical Director, William Paris. The following are past presidents: John M. Faircloth, Jas. J. O'Hearn, John W. Knott, F. H. McCausland, Jas. Phinnemore, Jas. Kitchener, J. B. Thomson, David Gould, Wm. M. Weekes, Stanley Taylor, J. R. Robinson and Geo. Alexander.

Objections to Incorporation of B. C. Architects

Many objections to the bill to incorporate the British Columbia architects were urged before the private bills committee. Mr. Jackson, the chairman, read telegrams from the B. C. Manufacturers' Association, the General Contractors and Master Builders' Association, the Imperial Oil Company and the American Can Company of Vancouver, all objecting to various phases of the bill. The Imperial Oil Co. and the American Can Co. stated that their plans were drawn at headquarters and the bill would compel them to employ a local architect who might not undertsand the peculiar nature of their business. The objection of the master builders was that builders competent to design buildings under the value of $5,000 would be put to the expense and trouble of employing architects for work they would do themselves.

The largest single road project in the United States, which is known as the Arkansas-Louisiana highway, will result in the construction of 153 miles of roadway, of which 111 miles will be of asphaltic-concrete on a cement-concrete base.

No. 15

Canada's Engineers—F. E. Field

Frederick E. Field, assistant superintendent of the Montreal Water Department, has been specializing for 24 years on waterworks engineering. During this time he has been connected with the design and construction of waterworks and filtration plants in a number of cities throughout the Continent. Mr. Field was born in 1873 in Montague City, Massachusetts, and, after receiving his preliminary education in the grammar schools of Lowell and Avon, Mass., the high school of Northampton, Mass., and the Williston Seminary, Easthampton, Mass., he studied sanitary engineering at the Massachusetts Institute of Technology, graduating in 1896 with the degree of B. Sc. Following his graduation, he became assistant engineer in the water department of the City of Boston and for 5 years was in charge of the surveys for, and laying of, pipe lines for extensions to the water distribution system of that city. This work also involved office work pertaining to the department, consisting of designs, records, etc. In 1901 Mr. Field became connected with the filtration staff of the city of Philadelphia. For the first few months he was engaged on the designs for a $17,000,000 extension to the city's water supply, later being made assistant engineer in charge of the construction of the so called "Upper Roxborough Filter Plant." This consisted of eight ¾-acre slow sand filter beds and the necessary accessories. Mr. Field resigned in 1903, when the work was practically completed and ready for operation, accepting a position with Chapin & Knowles, consulting engineers, Pittsburgh, Pa. While with this firm, he assisted in the design of the new filter plant for Lawrence, Mass., and designed and took charge of the construction of a waterworks system for Berlin, Pa. In 1904 he joined the filtration staff of the city of Pittsburgh, where he was in direct charge of designs and specifications of a large slow sand filter plant. After the award of the contracts, he became division engineer in charge of construction and in 1905 he became principal division engineer in direct charge of the construction of the whole waterworks enlargement involving nearly $6,000,000. He remained in this connection until 1910 when he was engaged as assistant engineer for the Pittsburgh Flood Commission and was almost entirely responsible for the chapter in their report on the prevention of floods by storage reservoirs.

From March, 1911, to July, 1911, Mr. Field was with Hering & Fuller, consulting engineers of New York city, in connection with the filtration plant for the city of Montreal. When contracts were awarded for this plant, he was engaged by the city of Montreal as their resident engineer, and in November, 1914, he also became resident engineer on the Montreal aqueduct enlargement works. After the Montreal filter plant was put in service in April, 1917, Mr. Field was in charge of its operation. He has also been directly in charge of the Church St. bridge and LaSalle bridge contracts which form a portion of the Aqueduct works. Part of his time was taken up in preparing data for the city's side of the Aqueduct litigation. Mr. Field has also been associated with studies and designs for proposed extensions to the Montreal Filtration Plants and for part of the waterworks system. He was also connected in a consulting capacity with the city of St. Hyacinthe, having prepared designs and specifications for their filter plant. He is a M.E.I.C. and M. Am. Soc. C. E.

Mr. Frederick E. Field

Oshawa Shows Great Industrial Expansion

The considerable industrial expansion that has taken place in the town of Oshawa, Ont., during the last calendar year places that municipality in the lead among Ontario cities and towns in the value of building permits per capita issued during the twelve months. With a population of 12,500, Oshawa had building permits issued to the extent of $2,332,540 in 1919. This is equivalent to building permits to the value of $186,613 for each one thousand unit of population.

Ontario Road Development

"About 25 per cent. of the highways of Ontario, or roughly, 1,800 miles, are scheduled for improvement and construction," said W. A. McLean, Deputy Minister of Public Highways, in an address recently to the members of theRetail Automobile Branch of the Retail Merchants' Association in a three-day convention at Toronto. It was pointed out by Mr. McLean that the construction of good roads was necessarily a slow process, and the public would have to be patient and permit the system to grow and develop.

"I look forward to the time when we will have approximately one car for every family in Ontario, which will mean 500,000 cars in the Province," he said. Last year, the Deputy Minister stated, 140,000 cars had been registered—a growth of about 20,000 cars for the year. The enormous increase of vehicular traffic over the roads of the Province was going to require increased expenditures of money for upkeep and maintenance, and Mr. McLean estimated that for the next five years, the government would annually spend $12,000,000 on the roads, or about $60,000,000 in the next five years ,on the 40,000 miles of roads in the Province.

16-Storey Hotel in Montreal Not Permitted

The Administrative Commission of Montreal has decided to reject the application for the construction of a sixteen-storey hotel in Montreal. The position taken by the Administrative Commission is, in substance, that they did not think it was in the interests of the city to amend the building by-laws in such a way as to permit buildings of a greater height than ten storeys in Montreal.

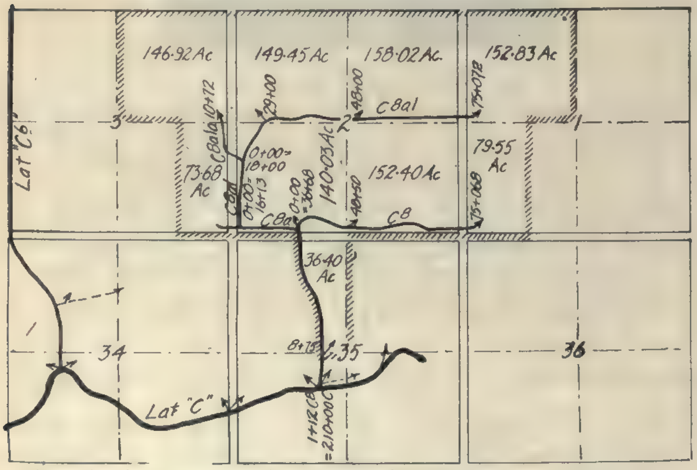
Determination of Lateral Capacities to Supply Irrigation Requirements

Procedure Used in Calculating Size and Profile of Ditches, Taking Seepage Loss into Consideration—How Crop Requirements Govern Application of Water and Period of Irrigation

By J. L. Franzen*

THE Irrigation Requirements or Duty of Water, vary greatly with the different localities, depending upon the length of growing season, kind of crops, relative amount of rainfall and upon the physical conditions of the land with reference to the character of the soil, drainage conditions and the effect of sub-irrigation.

The Government requirements under which water right applications are made, required water to be delivered to the land equivalent to a continuous flow of one cubic foot per second for 150 acres for a period of five months, May to September, inclusive. This would amount to two acre-feet per acre. This requirement may, however, be reduced to 1.5 acre-feet. From all the data available, for large areas of land on which a variety of grain and forage crops are produced, an average of 1.5 acre feet of water when economically applied to land is ample to grow the maximum yields. Therefore, 1.5 acre feet has been taken as the Duty of Water for the lands of this company.



Map showing areas served by lateral C8, the capacity of which is determined in the article

Due to climatic conditions, it is necessary to deliver, during the different months, a varying proportion of the total requirements. From data available, it has been assumed that the relative amounts of water required by monthly periods for the lands of this project, to be approximately as follows:—May, 10 per cent; June, 30 per cent.; July, 35 per cent.; August, 20 per cent.; September, 5 per cent.

On this basis, the maximum amount of water to be delivered during any month would be 35 per cent. of the total requirement, 1.5 acre feet, or a depth of 6 inches would be required on the land in the month of July. It is proposed to construct the irrigation system at such capacity that the rate of flow to irrigable land will be such as to provide a 4 inch irrigation within a ten day irrigation period, or equivalent to a 6 inch irrigation in 15 days.

All Water Supplied in Short Period

It is necessary in irrigation to provide sufficient capacity in laterals, delivering to farm units, so that all the water required may be supplied in a few days for the following reasons:—

1. All of the crop growing on a farm unit may need irrigating quickly. Should a small quantity be delivered for a long period of time, part of the crop would dry up while other parts were being irrigated.
2. Due to excessive seepage and evaporation, a small quantity of water cannot be economically applied to the land. On account of the excessive seepage, the upper end of the tract will be swamped before the lower end has sufficient water.
3. Because of the large seepage losses in the continued use of small quantities of water, the underground water surface is raised to the detriment of deep rooted plants, and it also forces to the surface any salts contained in the soil, and finally necessitates the reclaiming of the land by elaborate drainage systems.
4. It is a saving of time and expense to the irrigator to use a large "ditch head" at intervals over a short period of time than to use a small ditch requiring all of the irrigator's time.

Irrigation Period and Depth of Application

It is desirable, therefore, that the supply of water to be delivered to farm units be sufficient to supply the land within an irrigation period of ten days, which period of time, properly adjusted to the growing requirements of a crop, will protect against loss, and give the irrigator a sufficient "head of water" to put it to most economical use, both in regard to the amount of water used and also time consumed in applying it to the land.

The depth of water which may be practically applied to the land in any irrigation period may vary with respect to: the texture of the soil, the degree of perfection to which the land has been prepared for irrigation, and the method used in applying the water, i.e., border system, furrow, etc. Considering these factors upon a practical basis, for the lands in question, it is considered that a 4-inch application of water during any one irrigation period will be sufficient for all crops, and that full measure for the whole of the crop-growing season will be supplied by repeating 4 inch irrigation at such intervals of time as the respective kind of crops may require. For most crops, a repeated irrigation would not be required for fifteen to twenty days.

Irrigation Factor

When considering large areas of irrigable land planted to a variety of crops, having a different rate of growth, a different time for maturing, and varying as to quantities and time when water is needed, it is reasonably assumed that all of the lands in a large tract will not have to be irrigated simultaneously in any one irrigation period, but however, that any small tract constituting a part of the whole may need water for all of its area during one irrigation period. The irrigation factor or percentage of land requiring water at one time, not only applies to the proportion of land on any one farm unit requiring irrigation at once, but also as regards the ratio of a farm as a unit to the total number of farms, the aggregate of which make up the whole. In other words, on any one farm unit say of 160 acres, several different kinds of crop may be grown, and out of the 160 acres, it is possible that not more than 80 acres would need to be irrigated in any one irrigation period, but on the other hand, all of a farm unit may be planted to one crop, i.e., one say of alfalfa, a second to wheat, a third to oats, etc., any of which considered individually would require a 100 per cent. irrigation factor, but when these several units are considered in the aggregate, the irrigation factor would be less than 100 per cent., because considering the variety of crops, different times of planting etc., water for the respective crops would not be required simultaneously, and it follows that for larger areas with greater diversity of crops, the irrigation factor would decrease as the area increased.

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*Assistant Chief Engineer, Canada Land and Irrigation Co., Ltd., Medicine Hat, Alta.

As a general example, it may be assumed that for a large tract, one-half of the land is in forage crops and the other half in grain crop. It may be assumed that these respective crops may not require irrigation simultaneously, and that each respective crop may be irrigated at alternate ten day irrigation periods. These would probably be more frequent irrigations than required, but in that event, the irrigation factor for the whole area would be 50 per cent.

It is problematical as to the ratio at which the irrigation factor will decrease as the areas of land may increase, but for the purposes herein undertaken, it is assumed that the irrigation factor will vary from 100 per cent. for an area of 160 acres to 60 per cent. for an area of 5,120 acres, and continue at 60 per cent. for all areas in excess of 5,120 acres.

Table I.—Net Quantities of Water to be Delivered for a Given Area at a Given Irrigation Factor

160ac. Units	Gross Irrig Area	Net Disch Q c.f.s.	Irrig. Factor Per Cent.	Ratio of Net Del. to gross Irrig. Area
1	160	2.7	100.00	1:59
2	320	5.3	98.71	1:60
3	480	7.8	97.42	1:62
4	640	10.3	96.13	1:62
5	800	12.6	94.84	1:63
6	960	15.0	93.55	1:64
7	1120	17.2	92.26	1:65
8	1280	19.4	90.97	1:66
9	1440	21.5	89.68	1:67
10	1600	23.6	88.39	1:68
11	1760	25.6	87.10	1:69
12	1920	27.4	85.81	1:70
13	2080	29.3	84.52	1:71
14	2240	31.0	83.23	1:72
15	2400	32.8	81.94	1:73
16	2560	34.4	80.65	1:74
17	2720	36.0	79.36	1:76
18	2880	37.4	78.07	1:77
19	3040	38.9	76.78	1:78
20	3200	40.3	75.49	1:79
21	3360	41.6	74.20	1:81
22	3520	42.7	72.91	1:82
23	3680	43.9	71.63	1:84
24	3840	45.0	70.33	1:85
25	4000	46.0	69.04	1:87
26	4160	47.0	67.75	1:89
27	4320	47.7	66.46	1:91
28	4480	48.7	65.17	1:92
29	4640	49.4	63.88	1:94
30	4800	50.1	62.59	1:96
31	4960	50.7	61.30	1:98
32	5120	51.2	60.00	1:100

All areas over 5120 are computed with 60 per cent. Irrigation Factor.

Capacity of Laterals

Upon the basis of the foregoing, the irrigation system is designed to deliver a net quantity of water at the respective irrigation factor for the area of land in question, and at a rate of flow that will deliver

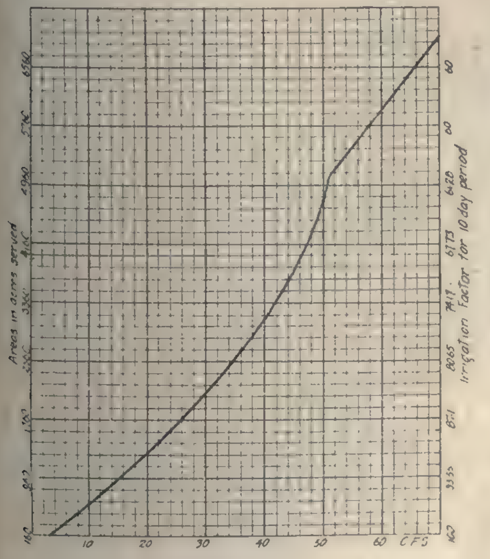


DIAGRAM 1

Curve to determine quantities of water to be delivered to given areas for a given irrigation factor

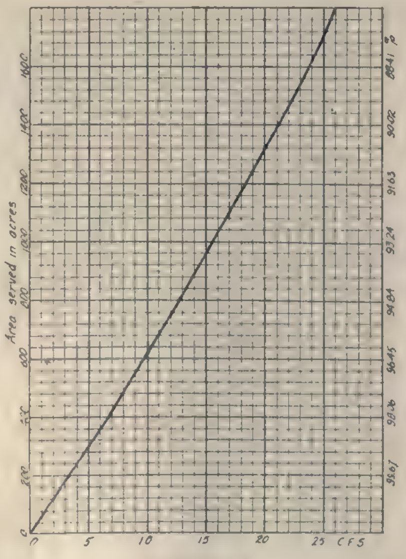


DIAGRAM 2

This diagram is the lower portion of diagram No. 1 plotted to a larger scale to facilitate determination of of quantities

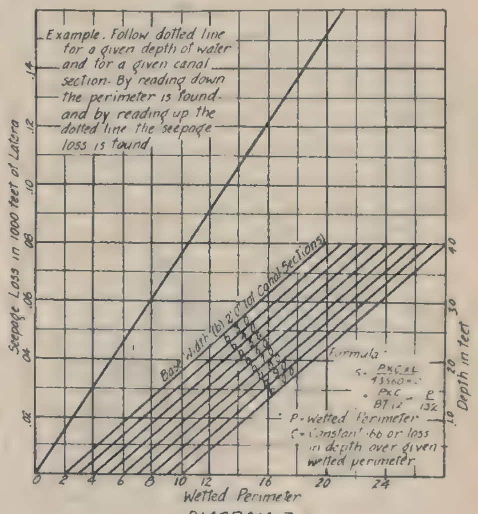


DIAGRAM 3

Shows seepage losses per 1,000 ft. of lateral; also the wetted perimeter, given base width of canal and depth of water

a 4-inch application within an irrigation period of ten days.

In process of consumption, the net capacity Q is determined by multiplying the area (A) by the irrigation factor (F), which gives the net area to be irrigated. As the depth of application (D) is 4 inches, or .33 feet, multiplying by .33 gives the net acre feet to be delivered, and as this quantity is to be delivered within the irrigation period (P) in 10 days, dividing by 10 gives the number of acre feet to be delivered in one day of 24 hours, which is converted to flow in cu. ft. per second, approximately, by dividing by 2.

A formula may be expressed as follows:—

$$Q = \frac{A \text{ x } F \text{ x } D}{P \text{ x } 2}$$

and reduces to simpler form upon substituting for the factors D = .33 ft. and P = 10 to read:—

$$Q = \frac{A \text{ x } F}{60}$$

To the net quantity Q, as determined in the foregoing, there must be added an increase in capacity necessary to compensate for losses by seepage and evaporation.

Seepage and Evaporation

Loss by seepage and evaporation varies widely. Evaporation is a small proportion of the total loss and varies with climatic conditions, and will hardly exceed under any circumstances, one-half inch per day, and for the most time much less, whereas seepage may vary for different materials from a third of a foot to 2 feet per day. For practical purposes as related to ditch capacities, evaporation may be neglected.

The following figures represent the average results obtained from observations on several hundred miles of canals on eight different irrigation projects of the U. S. Reclamation Service, and give a fair idea of what may be expected in the way of seepage losses in canals in the different materials represented. The losses are expressed in terms of the depth in feet during 24 hours through the wetted perimeter of the canal prism.

Kind of Material	Depth loss in feet per 24 hours
Cement, gravel and hardpan with sandy loam	0.34
Clay and clay loam	0.41
Sandy loam	.66
Volcanic ash	.68
Volcanic ash with some sand	.98
Sand and volcanic ash or clay	1.20
Sandy soil with some rock	1.68
Sandy and gravelly soil	2.20

For land under contemplation, the character of the soil may be generally classified as sandy loam with some small degree of variation in relation to the predominance of sand and clay, and the depth loss is taken at .66 feet.

In computing the added capacity to canals and ditches to compensate for seepage losses, the amount is determined by applying the loss in depth seepage factor (C) to the wetted perimeter (P) for a length of canal (L) 1,000 feet, and converting the volume thus obtained to equivalent in flow in cu. ft. per sec. as:—

$$S = \frac{P \text{ x } C \text{ x } L}{43560 \text{ x } 2}$$

Substituting C = .66 and L = 1000 ft., this formula is obtained:

$$S = \frac{P}{132}$$

Table II.- Functions for Determining Canal Sections

Bottom Width b	Depth d	Area a	Wet. per. p	Hyd. rad. r	S=.001		S=.00125		S=.0015		S=.00175		S=.002	
					V	Q	V	Q	V	Q	V	Q	V	Q
2.0	1.0	4.00	6.46	.62	1.36	5.4	1.53	6.1	1.67	6.6	1.80	7.2	1.94	7.7
“	1.2	5.28	7.35	.72	1.44	7.6	1.72	9.1	1.87	9.9	2.03	10.7	2.18	11.6
“	1.4	6.72	8.25	.81	1.69	11.7	1.87	12.6	2.05	13.8	2.21	14.8	2.36	15.8
“	1.6	8.32	9.15	.91	....	....	....	....	....	....	....	....	....	....
3.0	1.0	5.00	7.46	.67	1.45	7.2	1.62	8.1	1.76	8.8	1.90	9.5	2.04	10.2
“	1.2	6.48	8.35	.77	1.54	10.0	1.81	11.8	1.96	12.7	2.14	13.9	2.30	14.9
“	1.4	8.12	9.25	.88	1.69	13.8	2.00	16.2	2.20	17.8	2.38	19.3	2.54	20.6
“	1.5	9.00	9.70	.92	1.76	15.8	2.10	18.9	2.30	20.7	2.49	22.4	2.64	23.7
“	1.6	9.92	10.15	.98	1.84	18.2	2.18	21.6	2.38	23.5	2.58	25.6	....	....
“	1.8	11.88	11.05	1.08	1.97	23.5	2.34	27.6	2.56	30.2	....	....	....	....
“	2.0	14.00	11.95	1.17	2.09	29.3	2.48	34.7	2.70	37.8	....	....	....	....
4.0	1.0	6.00	8.46	.71	1.52	9.1	1.70	10.2	1.85	11.1	2.00	12.0	2.15	12.9
“	1.2	7.68	9.35	.82	1.70	13.0	1.90	14.6	2.08	16.0	2.25	17.3	2.38	18.4
“	1.4	9.52	10.25	.93	1.88	17.8	2.00	19.0	2.20	20.9	2.38	22.7	2.54	24.1
“	1.5	10.50	10.70	.98	1.94	20.4	2.09	22.0	2.30	24.2	2.48	26.1	2.64	27.7
“	1.6	11.52	11.15	1.03	2.01	23.2	2.17	25.0	2.38	27.5	2.58	29.7	....	....
“	1.8	13.68	12.05	1.14	2.11	29.7	2.34	32.0	2.57	35.0	....	....	....	....
“	2.0	16.00	12.95	1.24	2.30	36.0	2.48	39.7	2.70	43.2	....	....	....	....
“	2.2	18.48	13.80	1.34	2.45	45.4	2.64	48.8	....	....	....	....	....	....
“	2.4	21.12	14.70	1.43	2.57	54.3	....	....	....	....	....	....	....	....
“	2.6	23.92	15.60	1.53	2.68	64.2	....	....	....	....	....	....	....	....
5.0	1.0	7.00	9.46	.74	7.57	11.0	1.75	12.2	1.92	13.4	2.07	14.5	2.22	15.4
“	1.2	8.88	10.35	.86	1.76	15.6	1.97	14.5	2.16	19.2	2.34	20.8	2.50	22.2
“	1.4	10.92	11.25	.97	1.94	21.0	2.15	23.4	2.37	25.8	2.55	27.8	2.70	29.4
“	1.6	13.12	12.15	1.08	2.09	27.5	2.34	30.8	2.57	33.9	....	....	....	....
“	1.8	15.48	13.05	1.19	2.25	34.8	2.51	38.8	....	....	....	....	....	....
“	2.0	18.00	13.95	1.29	2.39	43.0	2.67	48.0	....	....	....	....	....	....
“	2.2	20.68	14.80	1.39	2.52	51.3	....	....	....	....	....	....	....	....
“	2.4	23.52	15.70	1.49	2.65	62.3	....	....	....	....	....	....	....	....
“	2.5	25.00	16.16	1.54	2.70	67.5	....	....	....	....	....	....	....	....
“	2.6	26.52	16.60	1.59	2.78	74.0	....	....	....	....	....	....	....	....
“	2.8	29.68	17.50	1.69	....	....	....	....	....	....	....	....	....	....
“	3.0	33.00	18.40	1.79	....	....	....	....	....	....	....	....	....	....

Table III.—Functions for Determining Canal Sections

Bottom Width b	Depth d	Area a	Wet. per. p	Hyd. rad. r	S=.0004		S=.0005		S=.0006		S=.0007		S=.0008	
					V	Q	V	Q	V	Q	V	Q	V	Q
2.0	1.0	4.00	6.46	.62	.84	3.36	.96	3.8	1.05	4.2	1.13	4.5	1.21	4.8
“	1.2	5.28	7.35	.72	.96	5.07	1.06	5.6	1.18	6.2	1.27	6.7	1.36	7.2
“	1.4	6.72	8.25	.81	1.05	7.00	1.17	7.8	1.30	8.7	1.39	9.3	1.50	10.1
“	1.6	8.32	9.15	.91	1.14	9.50	1.28	10.7	1.40	11.6	1.52	12.6	1.62	13.5
3.0	1.0	5.00	7.46	.67	.90	4.5	1.01	5.20	1.12	5.6	1.20	6.0	1.29	6.4
“	1.2	6.48	8.35	.77	.96	6.2	1.07	6.90	1.18	7.7	1.27	8.2	1.37	8.9
“	1.4	8.12	9.25	.88	1.05	8.2	1.17	9.50	1.29	10.4	1.39	11.1	1.50	12.2
“	1.5	9.00	9.70	.92	1.10	9.9	1.23	11.00	1.35	12.1	1.46	13.1	1.57	14.1
“	1.6	9.92	10.15	.98	1.13	11.1	1.29	12.90	1.41	14.0	1.53	15.2	1.65	16.4
“	1.8	11.88	11.05	1.08	1.23	14.6	1.38	16.40	1.52	18.1	1.64	19.5	1.76	20.9
“	2.0	14.00	11.95	1.17	1.31	18.4	1.47	20.60	1.61	22.5	1.75	24.5	1.87	26.2
4.0	1.0	6.00	8.46	.71	.94	5.6	1.05	6.3	1.16	7.0	1.27	7.6	1.35	8.1
“	1.2	7.68	9.35	.82	1.04	8.0	1.16	8.9	1.30	10.0	1.40	10.8	1.51	11.6
“	1.4	9.52	10.25	.93	1.16	11.0	1.31	12.4	1.43	13.6	1.55	14.9	1.67	15.9
“	1.5	10.50	10.70	.98	1.21	12.8	1.36	14.4	1.50	15.7	1.62	17.1	1.74	18.3
“	1.6	11.52	11.15	1.03	1.25	14.4	1.41	16.2	1.54	17.7	1.66	19.1	1.79	20.6
“	1.8	13.68	12.05	1.14	1.36	18.6	1.53	21.0	1.67	22.8	1.81	24.8	1.93	26.4
“	2.0	16.00	12.95	1.24	1.43	22.8	1.61	25.8	1.78	28.5	1.92	30.7	2.06	33.0
“	2.2	18.48	13.80	1.34	1.54	28.5	1.72	31.8	1.89	35.0	2.05	37.9	2.18	40.4
“	2.4	21.12	14.70	1.43	1.61	33.9	1.81	38.2	1.97	41.5	2.14	45.0	2.29	48.3
“	2.6	23.92	15.60	1.53	1.70	40.7	1.90	45.5	2.07	49.5	2.25	54.0	2.40	57.5
5.0	1.0	7.00	9.46	.74	.97	6.8	1.09	7.63	1.20	8.4	1.32	9.2	1.40	9.8
“	1.2	8.88	10.35	.86	1.10	9.8	1.23	10.9	1.35	12.0	1.46	13.0	1.57	14.0
“	1.4	10.92	11.25	.97	1.21	13.1	1.23	14.9	1.48	16.0	1.61	17.4	1.72	18.6
“	1.6	13.12	12.15	1.08	1.30	17.1	1.38	19.2	1.60	21.0	1.74	22.8	1.86	24.5
“	1.8	15.48	13.05	1.19	1.41	21.8	1.57	24.3	1.72	26.6	1.86	28.8	2.00	31.0
“	2.0	18.00	13.95	1.29	1.50	27.0	1.68	30.2	1.83	33.0	1.99	35.8	2.13	38.3
“	2.2	20.68	14.80	1.39	1.58	32.8	1.77	36.6	1.94	39.9	2.10	43.4	2.25	46.5
“	2.4	23.52	15.70	1.49	1.67	39.2	1.87	44.0	2.03	47.7	2.21	51.0	2.37	55.7
“	2.5	25.00	16.16	1.54	1.70	42.5	1.91	47.8	2.08	51.0	2.25	56.2	2.41	60.0
“	2.6	26.52	16.60	1.59	1.75	46.4	1.96	52.0	2.14	56.7	2.30	61.0	2.49	66.2
“	2.8	29.68	17.50	1.69	1.82	54.0	2.04	60.6	2.23	66.2	2.42	72.0	2.59	77.0
“	3.0	33.00	18.40	1.79	1.90	62.6	2.13	70.2	2.31	76.2	2.51	82.8	2.70	89.1

Tables and Diagrams

For convenience in computation of canal and ditch capacities, the following are prepared:—

Table 1 shows for various areas of land, in multiples of 160 acres, the net quantities of water required at the respective irrigation factors, also the ratio of the net delivery to the irrigable area.

Diagram Nos. 1 and 2 are compiled from Table No. 1. No. 2 is the lower portion of No. 1 plotted to a larger scale to facilitate reading.

Diagram No. 3 shows seepage loss expressed in cu. ft. per sec. per 1000 feet length, for a given wetted perimeter, and for which the seepage factor C is .66 ft. The diagram also gives the wetted perimeter in respect of various base widths of canal and depth of water, the side slopes being 2 to 1.

Table No. 2, 3 and 4 are for convenient reference in determining the desirable canal section, which at a required slope S and velocity V will discharge the desired computed capacity Q.

Table No. 5 shows the depth of Economic Cut (X), for ditches having side slopes of 2 to 1, and for varying factors of: D, total depth of canal section including free board, B, base width and W, top width of bank.

Example

A specific case will be taken up in detail to illustrate the use of the table and the method employed to determine the capacities of laterals.

Ditch capacities for the lateral system served by the main ditch C8 as shown on map are to be determined.

The first operation is to determine the respective irrigable areas that are to be supplied from different parts of the Lateral System as shown on Table No. 6. In determining these areas, it is necessary to begin at the lower end of the system and work up arriving at the areas served by each reach of lateral between deliveries where a change may occur in the cross section of the lateral (resulting from a change of gradient or other reasons), by which seepage losses would be altered.

Referring to the map and table and beginning at the lower end of lateral C8 from Sta. 75 + 068 to Sta. 48 + 50, the area served will be the west half of the south-west quarter of Sec. 1, or 79.55 acres.

At Sta. 48 + 50, an additional area will have to be served of 152.40 acres in the south-east quarter of Sec. 2, therefore the lateral from Sta. 48 + 50 to Sta. 36 + 68 will serve a total of 231.95 acres. At Sta. 36 + 68 lateral C8 as related to all points above, must in addition to the 231.95 serve 140.03 acres in the south-west quarter of sec. 2, making 371.98 acres, and also at this point, all areas under the branch laterals, C8a and its tributaries C8al and C8ala. Therefore proceeding further, it will be necessary to determine the areas coming under the branch C8a and tributaries, which is now taken up as follows:—

Beginning at the lower end of this system on lateral C8al, the reach of lateral between Sta. 75 + 072 back to Sta. 48 + 00 will have to serve 152.83 acres in the north-west quarter of Sec. 1.

From Sta. 48 + 00 to Sta. 29 + 00, the area to be served will be that in the north-west quarter of Sec. 1, 152.83 plus 158.02 acres in the north-east quarter of Sec. 2, or 310.85 acres.

From Sta. 29 + 00 to 18 + 00, there would be an additional area of 149.45 acres, a total of 460.30 acres.

At Sta. 18 lateral C8ala takes out, therefore, before

Table IV.—Functions for Determining Canal Sections

Bottom Width b	Depth d	Area a	Wet per p	Hyd. rad., r	S=.0002 V	S=.0002 Q	S=.0003 V	S=.0003 Q	S=.0004 V	S=.0004 Q	S=.0005 V	S=.0005 Q	S=.0006 V	S=.0006 Q	S=.0007 V	S=.0007 Q
6.0	1.4	12.32	12.25	1.00	....	....	....	....	....	....	1.38	17.0	1.50	18.5	1.64	20.2
"	1.6	14.72	13.15	1.12	....	....	....	....	1.35	19.8	1.50	22.1	1.65	24.2	1.78	26.2
"	1.8	17.28	14.05	1.23	....	....	1.24	21.4	1.44	24.8	1.61	27.8	1.75	30.3	1.91	33.0
"	2.0	20.00	14.95	1.33	....	....	1.31	26.2	1.53	30.6	1.71	34.2	1.86	37.2	2.03	40.6
"	2.2	22.88	15.80	1.44	1.12	25.6	1.40	32.1	1.62	37.0	1.82	41.7	1.98	45.3	2.15	49.2
"	2.4	25.92	16.70	1.55	1.18	30.6	1.47	38.1	1.71	44.3	1.92	49.7	2.10	54.3	2.27	58.9
"	2.6	29.12	17.6	1.65	1.25	36.4	1.54	44.8	1.79	52.2	2.00	58.2	2.19	63.8	2.37	69.1
"	2.8	32.48	18.5	1.75	1.30	42.2	1.61	52.3	1.87	60.8	2.09	68.0	2.29	74.6	2.47	80.3
"	3.0	36.00	19.4	1.85	1.36	49.0	1.68	60.5	1.95	70.1	2.18	79.0	2.38	86.0	2.57	92.7
8.0	2.0	24.00	16.9	1.41	1.10	26.4	1.38	33.2	1.59	38.3	1.79	43.0	1.95	46.9	2.12	50.5
"	2.2	27.28	17.8	1.53	1.18	32.2	1.46	39.8	1.69	46.1	1.89	51.5	2.09	57.0	2.25	61.3
"	2.4	30.72	18.7	1.64	1.24	38.1	1.53	47.0	1.78	54.7	2.00	61.4	2.18	67.0	2.36	72.3
"	2.6	34.32	19.6	1.75	1.30	44.6	1.61	55.2	1.87	64.1	2.09	71.8	2.29	79.0	2.47	84.8
"	2.8	38.08	20.5	1.86	1.36	51.8	1.69	64.3	1.95	74.2	2.19	83.5	2.40	91.3	2.58	98.7
"	3.0	42.00	21.4	1.96	1.42	59.7	1.75	73.5	2.03	85.2	2.27	95.5	2.49	102.3	2.69	106.4
"	3.2	46.08	22.3	2.07	1.48	68.2	1.83	84.2	2.11	97.0	2.34	103.8	2.59	109.7	....	....
"	3.4	50.32	23.2	2.17	1.53	77.1	1.89	95.4	2.18	105.0	2.42	122.0	2.67	134.0	....	....
"	3.6	54.72	24.0	2.27	1.58	86.5	1.95	103.3	2.25	121.4	2.51	138.4	....	....	....	....
"	3.8	59.28	24.9	2.37	1.63	96.5	2.01	119.3	2.33	139.0	2.60	152.0	....	....	....	....
"	4.0	64.00	25.8	2.47	1.69	104.0	2.07	132.0	2.39	153.0	2.67	170.5	....	....	....	....
10.0	2.0	28.00	18.9	1.48	1.15	32.4	1.42	39.7	1.65	46.2	1.85	51.7	2.02	56.5	2.20	61.6
"	2.2	31.68	19.8	1.60	1.22	38.6	1.56	47.5	1.75	55.4	1.96	62.1	2.15	68.1	2.32	73.5
"	2.4	35.52	20.7	1.71	1.28	45.4	1.58	56.4	1.85	65.2	2.06	73.2	2.25	79.8	2.43	86.2
"	2.6	39.52	21.6	1.83	1.35	53.3	1.67	65.8	1.93	76.2	2.16	85.3	2.36	93.2	2.55	108.0
"	2.8	43.68	22.5	1.94	1.40	61.1	1.74	76.0	2.01	87.9	2.25	98.3	2.47	104.0	2.66	116.0
"	3.0	48.00	23.4	2.05	1.47	69.0	1.81	87.0	2.09	100.3	2.32	111.0	2.56	122.5	....	....
"	3.2	52.48	24.3	2.16	1.53	80.3	1.89	100.0	2.17	107.0	2.43	127.8	2.67	140.0	....	....
"	3.4	57.12	25.2	2.27	1.58	91.0	1.95	111.2	2.25	128.3	2.51	143.2	....	....	....	....
"	3.6	61.92	26.0	2.37	1.63	100.8	2.01	129.9	2.31	142.6	2.59	160.5	....	....	....	....
"	3.8	66.88	26.9	2.48	1.69	113.3	2.06	138.0	2.40	160.6	2.68	180.0	....	....	....	....
"	4.0	72.00	27.8	2.58	1.74	125.5	2.15	154.7	2.47	178.0	....	....	....	....	....	....

going further, the area served under this lateral will have to be determined as relating to capacities for points above.

Lateral C8ala Sta. 10 + 72 to 0 + 0 serves 146.92 acres in the north-east quarter of Sec. 3, therefore, the total area to be served at Sta. 18 will be 607.22 acres.

Proceeding again with lateral C8al there are no areas to be served between Sta. 18 back to Sta. 0 which intersects lateral C8a at Sta. 16 + 13.

At Sta. 16 + 13, 73.68 acres are to be served in the south-east quarter of Sec. 3, making a total at this point of 680.90 acres.

On lateral C8a, no additional areas are served back to Sta. 0, but Sta. 0 intersects lateral C8 at Sta. 36 + 68, at which point lateral C8 served 371.98 acres, as first determined above, making a total at this point of 1052.88 acres.

On lateral C8a from Sta. 36 + 68 back to Sta. 8 + 75, no additional areas are served, but at Sta. 8 + 75, 36.40 acres are served in the north-west quarter of Sec. 35, therefore, the lateral from Sta. 8 + 75 back to Sta. 1 + 12, would have to be of a capacity sufficient to supply a total of 1089.28 acres, which is the total for the entire system.

The next operation will be the compilation of "Net Delivery" for the areas as determined above. The "Net Delivery" is obtained by application of the formula $Q = AF/60$ or by a reference to the Table and Curves compiled with respect to the varying irrigation factor for respective areas concerned. To the "Net Deliveries" thus determined are to be added additional capacities to compensate for losses through seepage and evaporation as indicated in the next column on Table 6.

Seepage Losses

The method of determining the seepage losses is based on the same procedure as that used for determining the areas as in each successive reach of lateral from the lower end towards its source. Additional capacity must be added to supply the seepage, not only from the reach in question, but for all parts of the lateral below.

At this point, we refer to the profile of the lateral

Table V.—Economic Cuts for Given Total Depth, Base Width and Top Width of Bank

Depth D. Ec. Cut	B=2 W=2 X	B=3 W=3 X	B=4 W=3 X	B=5 W=4 X	B=6 W=4 X	B=8 W=6 X	B=10 W=6 X
1.0	.62	...	...	...	...	...	...
1.2	.74	...	...	...	...	...	...
1.4	.86	.87	...	...	...	...	...
1.6	.98	.99	...	...	...	...	...
1.8	1.10	1.11	...	...	...	...	...
2.0	1.21	1.23	1.17	1.19	...	...	...
2.2	...	1.35	1.28	1.31	...	...	...
2.4	...	1.46	1.40	1.43	...	...	...
2.6	...	1.58	1.51	1.54	...	...	...
2.8	...	1.70	1.63	1.66	...	...	...
3.0	...	1.82	1.75	1.77	1.71	1.76	...
3.2	...	...	1.86	1.89	1.82	1.87	...
3.4	...	...	1.98	2.00	1.94	1.99	...
3.6	...	...	2.09	2.12	2.05	2.11	...
3.8	...	...	2.21	2.23	2.17	2.22	...
4.0	...	...	2.32	2.35	2.28	2.34	2.23
4.2	...	...	...	2.46	2.39	2.45	2.34
4.4	...	...	...	2.58	2.51	2.56	2.45
4.6	...	...	...	2.69	2.62	2.68	2.57
4.8	...	...	...	2.81	2.74	2.79	2.68
5.0	...	...	...	...	2.85	2.91	2.79
5.2	...	...	...	...	2.96	3.02	2.90
5.4	...	...	...	...	3.08	3.14	3.02
5.6	...	...	...	...	3.19	3.26	3.13
5.8	...	...	...	...	3.31	3.37	3.25
6.0	...	...	...	...	3.42	3.49	3.36

Table VI.—Tabulation of Factors Involved in the Determination of Capacity of Lateral System

Lateral	Length of Reach Sta. to Sta.		Irrig. Area	Total Irrig. Area	"Q" c. f. c.	Seepage	Total Seepage	Required Q.	Ditch Factors			Capacity at nearest standard section
									S	B	d	
C8	75-07	65-00	79.55	79.55	1.33	.05	.05	1.38	.002	2	1.0	(a) 7.7
	65-00	48-50	0	79.55	1.33	.08	.13	1.46	.001	2	1.0	5.4
	48-50	36-68	152.40	231.95	3.75	.07	.20	3.95	.001	2	1.2	7.6
	36-68	-	140.03	371.98	6.10	0	.20	6.30	...	2	1.2	7.6
C8al	75-07	60-00	152.83	152.83	2.55	.07	.07	2.62	.0015	2	1.0	6.6
	60-00	48-00	0	152.83	2.55	.06	.13	2.68	.001	2	1.0	5.4
	48-00	29-00	158.02	310.85	5.20	.11	.24	5.44	.001	2	1.2	7.6
	29-00	18-00	149.45	460.30	7.60	.07	.31	7.91	.001	2	1.4	11.7
C8ala	10-72	0-00	146.92	146.92	2.50	.05	.05	2.55	.001	2	1.0	5.4
C8al	18-00	0-00	0	607.22	9.80	.11	.47	10.27	.001	2	1.4	11.7
C8a	16-13	0-00	73.68	680.90	10.80	.11	.58	11.38	.00125	3	1.2	11.8
C8	36-68	-		1052.88	= Total area under C8a, C8al, C8ala and below C8							36-68
	36-68	8-75	0	1052.88	16.40	.22	.80	17.20	.001	3	1.6	18.2
	8-75	1-12	36.40	1089.28	16.75	.07	.87	17.45	.001	3	1.6	18.2

Note.—(a) Capacity at nearest standard ditch section at respective gradients (S), as obtained from Tables 4- 4a- 4b.

in question and for the bed gradient as laid down on the profile, a trial section is taken from the Table, 2, 3 and 4, which will supply the net delivery as determined with an estimated allowance for seepage loss. For the section so taken, reference is made to the diagram No. 3, and for the required depth of water a wetted perimeter is obtained, and by it from the seepage curve, the seepage loss is obtained per 1,000 ft. length of lateral. Applying this factor to the actual length of Canal gives the total seepage loss for the reach in question. This amount is then added to the "Net Delivery" computed for the reach, and if this amount approximates, but is not less than the capacity Q as first taken from Table 2, 3 and 4 above referred to, the section is adopted.

Excepting for a reach of considerable length where the seepage loss would be large, it will seldom occur that the section first chosen will require to be enlarged, and if so, can usually be covered by an increase to the depth of water of less than 1/10 of a foot.

New Road from Montreal to Quebec

Grand'Mere, P. Q., is contemplating the creation of a Board of Trade. The initial task of the board would be to promote the idea of a national highway that would lead from Montreal to Quebec running through St. Jerome, Joliette, Shawinigan Falls, and Grand'Mere, then proceed to St. Tite, County of Champlain, St. Raymond, County of Portneuf, and through the northern section of Quebec County to Quebec City.

F. C. Austin Company Expands

The F. C. Austin Machinery Co. is organized to take over the entire business of the F. C. Austin Company, Inc., the Municipal Engineering and Contracting Co., and the Muskegon plant of the Linderman Steel and Machine Co. It retains the personnel of both companies, whose combined efforts will be directed towards supplying the demand for the Austin lines of machinery. The combination of Austin and Linderman plants increases eight fold the past capacity of the Austin, which makes this new company's facilities one of the largest organizations for the manufacture of earth-loading and cement-working machinery in the United States. Mr. F. C. Austin retires from the active management, and the president of the Linderman Company, Mr. B. A. Linderman, assumes full control. The offices of the company will be maintained in the Railway Exchange Building, Chicago.

Large Order for Railway Construction Equipment

F. H. Hopkins, vice-president of the Hart-Otis Car Company, Montreal, announces that his company is in receipt of ballast and general service cars. The order will approximate $1,500,000 and was received from the Canadian National Railways. This equipment is for use in track maintenance and the building of new lines.

St. Lambert-Levis Highway to be Rushed

A delegation from the county of Lotbiniere, P.Q., waited upon the Minister of Highways of the Province of Quebec to request Government aid for the new St. Lambert-Levis highway, in order that the towns and parishes along the route may build their own sections of the road. The delegation were assured that the work on the highway will be rushed to the utmost during the course of the summer.

Filtration Plant for Hull

Owing to the refusal of the city of Hull to instal a mechanical filtration system, as ordered by the Quebec Provincial Board of Health, an action has been entered in the Superior Court by the Board of Trade. Severe penalties may be imposed for neglect to carry out the orders of the Board.

Drummond Workmen's Realties, Limited, Drummondville, P. Q., has recently been formed for the purpose of erecting dwelling houses of reasonable dimensions supplied with proper improvements, and intended to be let at a moderate price.

President C. S. Parker in opening the annual convention on Feb. 24th of the Clay Workers' Association of Western Ontario, urged the members to keep abreast of the times in regard to clay working machinery, so that costs may reduce and production increase.

Ontario's Progress in Housing Operations

Mr. J. A. Ellis, Director of Municipal Affairs, Reports Work Done During 1919 Under Ontario Housing Act — Housing Commissions in 99 Municipalities—$10,629,000 Apportioned by Government and $2,807,721 Actually Paid—1184 Houses Erected

THE Director of Municipal Affairs for Ontario, Mr. J. A. Ellis, has just prepared a report of the progress in housing operations during 1919 throughout the province. This report deals with the work which has been done under "The Ontario Housing Act, 1919," and contains suggestions regarding the work to be done in future under the Act. The Act referred to was assented to on the 20th of March, 1919, the administration of it being placed under the direction of the Director of the Bureau of Municipal Affairs. The Housing Branch of that Bureau was then organized.

It was necessary for each municipality coming under the provisions of the Act to appoint a housing commission and to organize its own local staff. Through its various officials the housing department has supplied a large amount of information, and given considerable assistance to the various housing commissions.

The organization of the housing department and of these housing commissions necessarily occupied considerable time. It was therefore not until August, 1919, that the actual construction of houses under the Housing Act can really be said to have commenced. Considering this, the results obtained in 1919, are, in the opinion of the Director, most satisfactory.

Cost of Houses

The Act fixed certain limitations as to the cost of the houses to be erected under it. Since it was passed, the cost of construction has steadily increased until it is now, taking an average all over the province, at least 25 per cent. greater than it was in March, 1919. This has added to the difficulty of obtaining the most desirable results under the Act.

"The cost of constructing houses," states Mr. Ellis in the report, "is now, taking an average all over the province, about 125 per cent. greater than it was before the war. In Great Britain the increase is nearly 300 per cent. Lumber has so greatly increased in price here that we have arrived at the stage where the cost of erection of a house of solid brick is not a great deal in excess of one of frame construction. As to the advisability of building a house of solid construction rather than of frame, from the point of view of durability and saving in maintenance, there never was any doubt. Considering these matters, I recommend the erection of houses of solid construction, especially where the comparatively small additional increase in the monthly payments over those of frame construction can readily be met by the person requiring the house."

During the war very few small houses were constructed. In consequence, at the close of the war, there was a great shortage of such houses in nearly all the urban centres of population. An estimate of such shortage is at least 20,000. Since the end of the war there has been a considerable expansion of industrial activity all over the province, which has accentuated the difficulty of dealing with the problem of the shortage of small houses.

Housing Commissions in 99 Municipalities

There are now ninety-nine municipalities which have passed by-laws under the provisions of the Act, and appointed housing commissions. Of these, 19 are cities, 49 towns, 17 villages, and 14 townships. Sixty eight municipalities have constructed houses. All these contemplate construction on a much larger scale in 1920. In addition, all municipalities, with two exceptions, which have not yet constructed houses, intend to do so in 1920.

It is to be noted that the city of Toronto did not adopt the provisions of "The Ontario Housing Act" but appointed a housing commission of its own. This commission has constructed a number of houses, the financing of which has been done by the city itself.

The following companies have become incorporated under "The Housing Accommodation Act" for the purpose of erecting houses under "The Ontario Housing Act, 1919."

Hawkesbury—The Riordon Annex Housing Co., Ltd.

Hamilton—The Wentworth Construction Housing Co., Ltd.

Fergus—The Fergus Housing Co., Ltd.

Iroquois Falls—The Iroquois Falls Housing Co., Ltd.

Listowel—The Listowel Housing Co., Ltd.

Kitchener and Waterloo—The Dominion Rubber System Housing Co., Waterloo, Ltd.

Kitchener—The Waterloo County Housing Co., Ltd.

The Riordon Annex Housing Co., Ltd., the Fergus Housing Co., Ltd., the Iroquois Falls Housing Co., Ltd., and the Listowel Housing Co., Ltd., have constructed houses under "The Ontario Housing Act, 1919," but the other companies have not yet done so.

Appropriations

The Dominion Government appropriated $25,000,000 to be loaned, pro rata to population, to the various provinces for housing purposes. This was to be loaned at 5 per cent. and the provinces were to reloan it at the same rate. The Province of Ontario's share of the $25,000,000 is $8,753,291.93. To this the province agreed, in an informal way, to add $2,000,000.

The total amount appropriated to municipalities by the province by Order-in-Council in 1919 was $10,629,000. Of this, $5,125,000 was appropriated to seventeen cities; $3,649,000 was appropriated to thirty-nine towns; $735,000 was appropriated to sixteen villages; and $1,120,000 was appropriated to eleven townships.

No appropriations have yet been made to two cities, ten towns, one village, and one township, because these municipalities came under the provisions of the Act within a comparatively recent period. Two townships have not asked for appropriations.

If all the requirements of the various municipalities for 1920 are met, about $8,000,000 more will have to be appropriated in addition to the $10,629,000 already appropriated. A large number of municipalities which have constructed a small number of houses this year, are contemplating large developments in 1920, in addition to those constructed in 1919, if appropriations are made sufficient to cover these.

The total loans approved for houses erected in 1919, is $3,677,974. Of this, $1,771,746 was to be loaned to seventeen cities, $1,311,897 to thirty-one towns, $286,905 to thirteen villages, and $307,426 to seven townships. Loans amounting to $941,640 have also been approved for houses which are not yet erected.

The total amount actually paid by the Province on account of such loans and the purchase of land for housing purposes in 1919, is $2,807,721.87. Of this, $1,426,568.60 was paid to sixteen cities; $1,007,826.17 to thirty towns; $208,929.80 to thirteen villages and $164,397.30 to seven townships.

Houses Erected

A summary of the houses erected in 1919 is as follows:

No. of Houses		Loans	Average Loan per house
14	Four roomed, frame clapboard finish..	$27,700.00	$1.978.57
3	Four roomed, solid brick, hollow tile or concrete	7,575.00	2,525.00
43	Five roomed, frame clapboard finish	115,489.00	2,685.79
26	Five roomed; frame stucco finish	77,050.00	2,963.46
23	Five roomed, brick veneer	67,270.00	2,924.78
44	Five roomed, solid brick, hollow tile, or concrete	124,630.00	2,832.50
237	Six roomed, frame clapboard finish	662,299.00	2,794.00
88	Six roomed, frame stucco finish	257,274.00	2,923.57
230	Six roomed, brick veneer	678,228.00	2,948.82
332	Six roomed, solid brick, hollow tile, or concrete	1,185,000.00	3,569.28
13	Over six rooms, frame clapboard finish	37,100.00	2,854.61
27	Over six rooms, frame stucco finish	81,000.00	3,000.00
23	Over six rooms, brick veneer ...	56,675.00	2,464.13
81	Over six rooms, solid brick, hollow tile or concrete	300,684.00	3,712.16
1,184		3,677,974.00	3,106.40

Of the above, 1,060 are detached houses and 124 are semi-detached.

Most of these houses are now occupied.

In addition to the above, 269 applications for loans, aggregating $941,640 have been approved for houses which are not yet erected.

It will be seen that 62 per cent. of the houses erected are either of brick veneer or of solid construction.

The average loan per house indicates that there is a reasonable margin of security in the loans made. About two-thirds of the houses have been erected by persons who own ther own lots. Such persons can obtain loans for the full cost of the house, but in a large number of cases the loans have been made for less than such full cost. Where houses are built under this plan, persons building them can make their own contracts for construction. Working men can also do part of the construction work themselves, and this has been done in many cases. The Department has encouraged this method. Persons wanting houses have each obtained the particular kind of house which they desired, subject to the minimum requirements of the Department. There has been no effort to force upon people any particular kind or kinds of houses. These methods are largely responsible for the success which has so far been obtained under The Ontario Housing Act.

Plans

When the work in connection with the administration of the Act was commenced, it was found that not sufficient attention was, as a rule, given to the planning of small houses, and that many contractors built houses which were not as well constructed as they should have been. The Department, through its various officials, has endeavored, with a remarkable degree of success, to get an improvement in the erection of houses of this class.

Special attention has been given to the planning of the houses from the point of view of having no space wasted in unnecessary halls or passages. It has been the endeavor to have every inch of space in the house made available for living purposes. The houses have been planned so as to secure the maximum of accommodation at the minimum of expense. They have also been planned so as to give as little labor as possible in connection with the care of them. The housewife has been saved all possible unnecessary going up and down stairs and travelling from one room to another, and the kitchen has been arranged so as to give her the minimum of labor there.

Before the Housing Act was passed, there appears to have been a general impression that it was unnecessary to carefully plan small houses. This frequently resulted in more money being expended than was required for the living accommodation which was actually secured.

Contained in this report are a number of plans of houses, nearly all of which have been actually constructed under the Act. The cost of construction is given and statements of cost will prove of considerable assistance in the work which will be done hereafter.

In nearly every municipality where houses have been erected the monthly payments for principal and interest, including taxes and insurance, are less than the rentals for similar houses in the same municipalities.

Each housing commission was asked to appoint a building inspector to supervise the construction of all houses erected under the Act, and nearly all the commissions did so. In addition, the department has employed building inspectors who have made periodic inspections of such houses. As a result, there is no question that the construction of the houses is generally very good and an improvement upon what had formerly been done.

Water, Sewerage, etc.

It has been insisted upon that every house should be supplied with water, and that where there were sewers all sanitary conveniences should be installed. Where there were no sewers, septic tanks or approved sanitary closets have been allowed. In all cases roughing in for all sanitary conveniences has been insisted upon, so that when sewers or septic tanks could be constructed the sanitary conveniences could be easily and economically installed. With regard to sanitary conveniences, the laying out of the land, the location of the house on the lot, and the general arrangement and appearance of the house, the rule of the Department has been that the best that could be done in any particular locality should be done.

Lots

A great deal of attention has been paid to the exact location of the house on the lot. Block plans have been insisted upon so that the best advice possible could be given as to the erection of the house from the point of view of securing the maximum of fresh air, sunlight and open spaces.

Small and narrow lots have been discouraged. In Toronto and its vicinity all land is much more expensive than in any other part of the province. Land values in the locality mentioned are unreasonably high, as compared with such values elsewhere. There has not been much difficulty in securing land at reasonable prices everywhere else for housing purposes. In this respect the special provisions of the Housing Act, with regard to the expropriation of land for housing purposes, have been very effective. There have only been two arbitrations under these provisions, but the very existence of them has, in a great many municipalities, enabled land to be purchased at a reasonable price where otherwise this might not have been the case.

As a rule, outside Toronto and its vicinity and the Windsor district, the lots used for housing purposes under the Act are not less than forty feet frontage by one hundred feet in depth.

Apart altogether from the erection of houses to overcome the shortage of small houses, Mr. Ellis thinks there is no doubt but that the housing standards for small houses will be improved in the municipalities where houses are erected under the Act. The result must be beneficial, and it is most probable that an improvement in the construction of such houses will be noticeable even after operations under the Act have been discontinued.

The Department has insisted upon a minimum size of rooms which is as follows:

Living room	144	sq. ft.	narrowest	dimension	11 ft.
Dining room	120	"	"	"	10 "
Kitchen	80	"	"	"	8 "
Kitchenette	50	"	"	"	6 "
Bedroom No. 1	120	"	"	"	9 "
Bedroom No. 2	100	"	"	"	8 "
Bedroom No. 3	75	"	"	"	7 "
Bathroom	35	"	"	"	5 "

Where the kitchenette opens from the dining room with a doorway of six feet, the minimum combined width of dining room and kitchenette including the intervening partition may be fifteen feet.

The minimum height of ceilings is eight feet. Each room has a window area of not less than twelve sq. feet, and the bathroom of not less than six sq. feet.

It has been insisted upon that the floor joists should be of ample dimensions and that sufficient of them should be put in to remove any possibility of the floors sagging.

In semi-detached houses the division walls are of solid construction.

What Year's Experience in Housing Has Taught

Chief Architect of Housing Department of Ontario Makes Recommendations for Guidance of Future Operations

As a result of a year's experience with the erection of houses under the Housing Act, some valuable ideas have been gained which will be of assistance to those who will carry on housing work in the future. Some of these are outlined in the following report of James Govan, chief architect of the Housing Department of Ontario:

From the work reviewed under the Ontario Housing Act during the past year some conclusions may be emphasized for the guidance of the commissions which have not yet started operations, but which intend to do so. They may also prove valuable to some of those operating even where considerable progress has already been made.

(1) Steady improvement in the quality of the plans received has been noticed with each succeeding month; and it is quite evident that where competent professional assistance is obtained by a commission, mistakes are avoided, economies are effected and the results in general will more than justify the expenditure on such service.

More careful study of elevations to preserve simplicity and get better proportion between parts is required for many of the schemes submitted for approval. This can only be done by men trained in design, but the employment of architects at the ordinary professional rates of remuneration is impossible for each individual house.

Owing to possible repetition of designs or variations not requiring separate sets of drawings, possibility of using standardized details and specifications, etc.; the services of the best architects experienced in this work can be obtained at a much lower cost per house than is usually charged for individual services on a single house.

Co-operation between the local branches of the architectural and art associations, societies, etc., and the housing commission might produce the desired improvement, but the creation of a central bureau to pass judgment on the aesthetic merit or demerit of each application would not, in our opinion, be desirable.

Much educational work along these lines requires to be done throughout the Province and how that is to be stimulated is a question which should be studied by every individual interested in the improvement of our Ontario homes. The various housing commissions operating throughout the Province during the past year should be congratulated on the advances they have made and should receive every encouragement to go further in their good work, for which, in too many cases, they have received too much criticism and no active help from the professional bodies which could do so much by co-operating.

Houses Built for Individual Applicants

(2) Of the total number of loans made last year a large proportion was to individuals for the erection of their own homes. While it is true that this is not an economical way of providing houses in large quantities in a short period of time, there are many reasons for encouraging this phase of the work under the Housing Act.

Splendid results have been obtained by many applicants who have carried out a great deal of the work on their own houses. This should be encouraged for at least two reasons, one—to develop craftsmanship, and the other—to help to keep down the amounts required for loans.

In my opinion, commissioners should take advantage of every opportunity to foster this spirit among applicants. It should be clearly understood that a man or woman contemplating the purchase of a home has a natural interest in its building, which is not satisfied by simply presenting him or her with the front door-key.

Wherever possible they should be encouraged to do their own home building; and failing that, the most lasting satisfaction will be got when they are allowed to exercise some control over the work from the development of their plan to its final realization as the home.

Building Houses in Quantities

(3) There is no limit to the number of types of houses which can be built under the Act. They are as numerous and as distinctive as the human individual, but it has been clearly proven that the only way to get low costs is to erect houses in quantity with standardized parts. This can be done and still provide the necessary variety in external appearance.

When houses are being built in quantities it is essential that the attention of commissions be drawn to the fact that in this case they are not only building houses, but also a community; and the appearance of the streets must be considered as well as each house. In a small town the erection of fifty or a hundred houses is a large percentage of the total number in the town. If these houses are attractive they will be an asset; on the other hand, if poorly designed and badly situated they will detract from the appearance of the town as a whole, and are apt to become a liability and the beginning of a slum district.

(4) In some localities bungalows consisting of cellar and all rooms on the ground floor have been erected for less cost than houses of two storeys, having the same accommodation and built of similar materials.

The only explanation which can be given is that with the present high cost of labour—the hoisting of materials to first floor and roof more than offsets the cost of the extra cellar and roof areas of the bungalow.

(5) Sufficient educational work has been done under the Act to show that houses three rooms deep are not necessary or desirable except on unusually wide lots or in very special circumstances, on very narrow lots. No exceptions will be made to the side clearances demanded in the "Report re Housing," printed last year, in checking plans of the three room deep type unless the middle room has a window to the rear in a break in line of side wall.

Location of Houses On Lot

(6) Too much attention cannot be given to the placing of houses on lots so that they will get the full benefit of direct sunlight into as many rooms as possible, especially during the winter months, when it is almost impossible to get sun purified air into homes through open windows and doors.

In many cases the placing of a verandah right across the front of a house has the effect of shutting sunlight out of a room throughout the entire year. This should be emphatically condemned in our climate where the ordinary verandah can only be used for a very few months of the year at most.

(7) Low cost housing can only be obtained by eliminating every foot of waste space. This has the inevitable effect of restricting the size of the kitchen. As this is the workroom much greater attention should be given by planners to the traffic lines through the kitchen and the relation between door openings and furniture spaces.

It has been only too evident during the past year that these feautres have not been given a sufficient amount of consideration. A small kitchen is only satisfactory when traffic lines will leave enough wall and floor space to accommodate the furniture which is essential for the work to be performed.

When this point has been studied it will be found that it is rarely desirable to provide a separate door opening out to the rear of the lot, in addition to the grade entrance to the cellar, which should also communicate with the kitchen.

Vestibule Protection

(8) Climatic conditions throughout most of Ontario make it extremely desirable to provide vestibule protection to the front door. This is even more important when the front door opens into a living room without any hallway.

The omission of a vestibule in such a case may result in a slight saving in cost, but it will never provide satsfactory living conditions here in winter. In every instance of this kind presented to us, we have noticed that there were other features of lesser importance which could have been omitted to keep the cost at the same figure.

(9) Some provision of space should be made for the hanging of hats and coats near the front entrance.

(10) Other features requiring study to keep the cost down but which seem too often to be ignored are:

Partitions on first floor should, wherever possible, come over ground floor partitions to save cost of beaming and permit of straight riser ducts for heating.

Plumbing fixtures should be arranged for bathroom, kitchen and laundry so as to make only one soil-stack necessary.

Hall and staircase space should be kept down to the smallest possible dimensions.

Simplicity in roof construction is essential. Hips, valleys, flashings, etc., in roofs are not only costly, but also expensive in maintenance.

More Attention To Ventilation

(11) As the cost of a house varies with its cubical contents the old fashioned large airy room is no longer economically possible. It, therefore, follows that it is now all the more necessary to study carefully the ventilation of our smaller houses and the value of the materials used in their construction from the standpoint of insulation against cold and heat.

In summer time, cross ventilation through windows is essential and on narrow lots this question could receive more thought than is usually given to it.

A great many schemes are submitted in which tops of windows are indicated too low down from the ceiling. In bedrooms especially, the distance from ceiling down to glass line should not exceed twelve inches.

(12) Where any part of the floor of a room comes over an open space below, such as a verandah, etc., special attention should be given to insulating the exposed area. The additional comfort in winter obtainable by the use of dry shavings insulation protected from dampness on both sides by water proof paper

will more than justify the very slight extra cost of such precaution.

(13) A tendency to make windows too small has been evident in many of the schemes submitted.

The areas demanded by the regulations are the minimum and in many cases should be exceeded. More satisfaction would be obtained if the glass area for each room were not less than ten per cent. of the floor area, where such an allowance would exceed the present minimum requirements.

(14) Where the temperature falls below zero it would appear that a good furnace is absolutely essential in a home. Some applicants evidently think that a furnace should only be thought of after they have crowded the outside of the house with useless, supposedly ornamental features and so-called "trim."

(15) Where there are local by-laws they must be followed in construction under the Housing Act. In some cases the requirements of these by-laws are unnecessarily severe and the local commissioners should endeavor to have them modified to reduce the cost of building small houses.

(16) Building conditions in Ontario vary so much that it is undesirable to attempt to write a specification which would be acceptable everywhere in the Province. Results up to date, however, indicate that no stucco should be used which is not damp proofed.

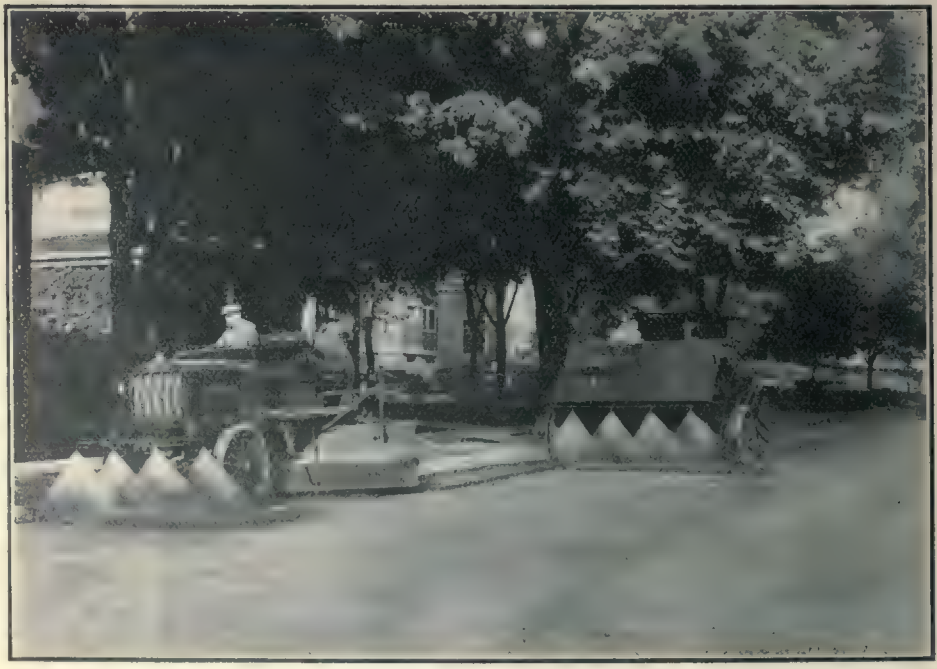
(17) A special paper on the insulating qualities of various materials commonly used in house construction is being prepared and will follow publication of this report as soon as certain experimental work, now being undertaken, has been completed.

Combined Road Sprinkler, Sweeper and Collector, Controlled by One Man

WHATEVER difference of opinion there may be as to the respective merits of various types of construction of roads, there is no difference as to the value of maintenance and the imperative necessity of keeping them clean. This, of course, is especially true of towns and cities where refuse accumulates quickly, and where the problem is of more vital importance than in the purely rural districts. A dirty town or city is not pleasant either for the inhabitants or for visitors, and its reputation in this respect has an influence in attracting business, population and visitors.

The problem of the street cleaning department naturally varies according to climatic conditions, but all civic officials are interested in adopting methods and equipment which are efficient and economical. The system with which we have been familiar is for a watering cart to do the sprinkling; men to more or less (chiefly less) efficiently sweep up the refuse and mud; and for the latter to be then carted away in dump carts. Often the water carts will send forth far too much water, with the result of diverting the refuse into the gutters and then into the sewers. The presence of excessive water is detrimental to the pavements while we are all aware of the nuisance in the summer time of piles of refuse on the streets, with the resulting clouds of dust. The whole system is expensive and certainly not efficient.

The Elgin system, herewith illustrated, works on a different plan. The machine, driven by motor, is a combined sprinkler, sweeper, and collector, and is controlled by one man. The water is sprayed from nozzles in cone-shaped sprays, the water being forced from the water tank, holding 180 gallons, by compressed air. The refuse, after being dampened, is swept on to a conveyer which carries it to the enclosed collection hopper, with a capacity equivalent to an hour's run under average conditions. It is claimed that this system is economical, efficient, sanitary, will not injure pavements, and is not burdensome to the sewers. The Auto-Sweeper is an auxiliary machine, which sweeps right from the gutter, for a path of seven feet. It is claimed that each of these machines has a maximum capacity of 48 miles of pavement in an eight hour day, and that the work can be done at a very large reduction in cost as compared with the usual methods.



A combined sprinkler, sweeper and collector in operation. Water is forced, by compressed air, through nozzles in cone-shaped sprays. Refuse is swept on a conveyor which carries it to an enclosed collection hopper

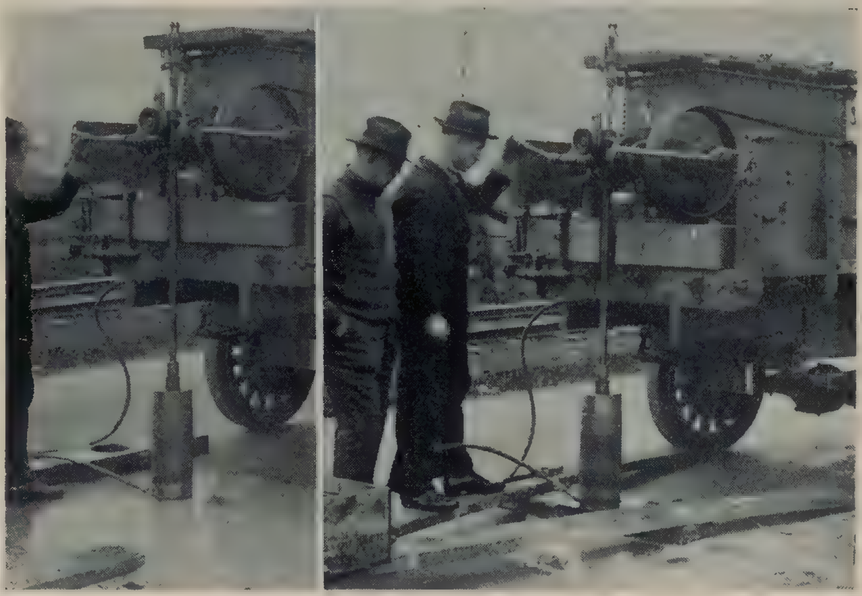
Core Drills as a Means of Securing Road Samples for Testing Purposes

Relative Merits of Different Types of Construction Determined by Tests of Specimens Extracted by Drills—Truck Mounted Equipment Successfully Used

By F. A. McLean*

WITH the close of the war and the inauguration of the so-called reconstruction period in Canada and the United States, large appropriations have been made, and will probably continue to be made for some years to come, for the construction of new and better highways and roads, and the repair and maintenance of those already in existence.

A remarkable feature in connection with this field of reconstruction has been the almost universal desire to obtain accurate records of the relative merits of the different substances used in road construction. This information is to be used as a basis for the determination of the materials best suited for use with various classes of traffic under different conditions, as an understanding of results secured in the past, is a guide to better attainments in the future.



These illustrations show the use of core drills for the production of road samples. The right-hand view indicates the method of starting the hole, using a plank, with a hole slightly larger than the cutting tool, to guide the drill. On the left is illustrated the drill in action after the hole has been started.

In many localities it has been found desirable to take and preserve samples from completed roads and streets, for the purposes of making laboratory tests indicating the thickness, resistance to compression, and climatic conditions of the various substances used in road building. The practice of taking these samples from the road by a gang of men armed with hammers and chisels, or picks, is unsatisfactory, both from the standpoint of labor cost, and the size and quality of the specimen obtained. It is practically impossible to get a solid piece representing completely the true thickness of the road bed, and the samples secured in this way, being irregular in shape, are difficult to store; and as they are liable to contain cracks and fissures as a result of the shocks imparted to them during their removal, they cannot be relied upon to give a true indication of the strength and wearing qualities of the road from which they were taken. Another objection to securing these samples by hand is the difficulty of adequately repairing the irregular shaped holes left in the pavement from which they are extracted.

Core Drills to Obtain Road Samples

A study of the good results secured in the testing of masonry foundations and walls, by the use of core drills, has led some of the more progressive municipalities and road and paving contractors in the United States, to use them as a means of obtaining high-grade samples of various paving materials, in which connection they have proved very satisfactory. Core drills are of two general types—diamond drills and shot drills. Diamond drills are usually not practical for extracting cores of a larger diameter than two inches, and while larger cores have been made, the high cost of the diamond-pointed bits usually prevents them from being applied to fields other than the exploration of large mines, where the cost of holes per foot drilled is of no great consequence. The Davis Calyx Core Drill uses, instead of diamonds as a cutting agent, a quantity of steel shot, which is fed to the edge of the bit by a stream of water under moderate pressure. Chilled steel shot costs only a few cents a pound and the diameter of the core obtained is only limited by the size of the outfit used.

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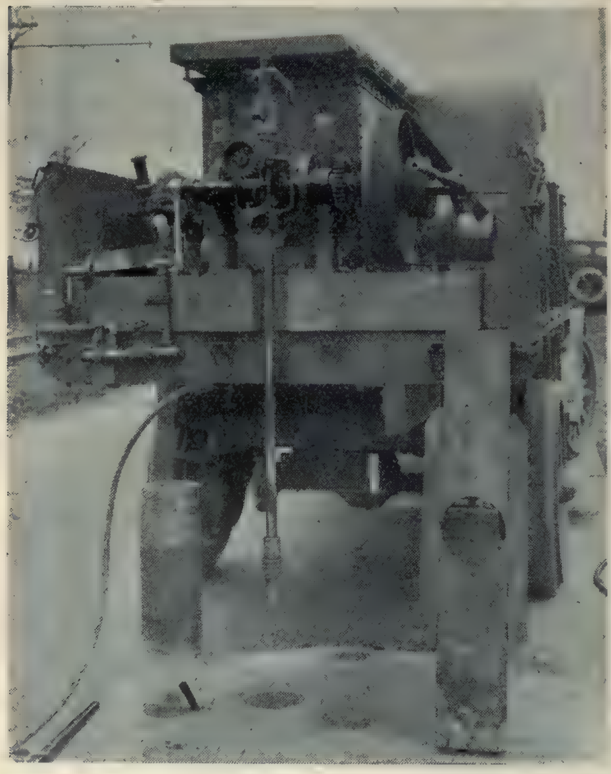
*Of Canadian Ingersoll-Rand Co., Sherbrooke, P.Q.

By the use of such a drill it is possible to quickly and cheaply secure cores through the road bed, of small diameter, with very few failures and without the use of a large amount of unskilled labor. This is done without danger of fracturing or destroying either the core or the pavement surrounding the hole from which it is extracted, and the hole being of comparatively small diameter, is easily repaired by filling it with a mixture of broken stone and cement, or by inserting a concrete cylinder slightly smaller than the hole to be plugged and filling in the interstices with cement.

Samples are of Uniform Size

The samples being of a uniform size may be depended upon to give more accurate indication of the strength and wearing qualities of the road bed than those extracted by hand and they also lend themselves more readily to tagging and storage for reference purposes. By the use of shot bit, 5½ in. in diameter, the diameter of the hole in the pavement will not exceed 5¾ in., and the core produced will be about 4½ in. in diameter when taken from material of a binding nature, such as concrete, tarvia, or similar substances. Loose material without any form of binder cannot be cored, but a cutter can be applied to the drill, which will cut a hole with straight sides in roadbeds of this type, thereby allowing an accurate examination of the sides of the hole to be made.



The bit or cutting tool and a sample core

Core drills of the type described are obtainable in a number of different sizes and styles for hand, electric, steam, or gasoline engine drive, and for portable and stationary use. Portable types mounted on wagons or automobile chassis are best suited for use in road and paving work. An outfit used by the City of Des Moines, Iowa, consists of a drill with steel frame, mounted on a substantially constructed four-wheeled hand truck and driven by a 1½ h.p. gasoline engine. As most of the work done with this outfit is performed on the city streets, the water required for washing the cuttings from the hole and feeding fresh shot to the bit is obtained from near-by hydrants, and where this is not possible a sprinkler cart is brought into play. This outfit is operated entirely by one man, and beyond the expense required for oil, gasoline, and steel shot, the pay of the operator is the only expense incurred in extracting the cores.

Production of Cores

Several hundred 4½ in. cores have been taken from concrete, brick, asphalt and bitulithic pavements with this outfit, the number of cores taken in a day varying according to the nature and depth of the matrial to be cored. On ordinary concrete pavement varying from 6 to 8 inches in thickness, it is possible to secure 12 to 15 cores per day. On harder pavements it is not practicable to maintain this speed. Production in the case of pavement over 8 inches in thickness where the concrete is composed of a gravel aggregate is from 6 to 7 cores per day. Cores may also be taken from brick pavements, providing the grouting material is of sufficient strength to hold the pieces of brick together during the cutting operation.

The radius of action of an outfit of this type is limited by the fact that it carries no tank, pump or other means of securing a supply of water and its use is therefore restricted to city streets where a source of water is near at hand. To provide a compact self-contained outfit, which would be capable of working anywhere along their many miles of excellent roads, the California Highway Association mounted their outfit on the chassis of an old Ford car with a large water tank and pump driven by the 5 h. p. gasoline engine which is used to drive the core drill.

With this equipment they can drill an average concrete pavement in from 10 to 12 minutes, and old roads made with gravel, consisting largely of indurated sandstone, in from 6½ to 10 minutes, while concrete made from particularly hard boulders, such as andesite, requires from 30 to 40 minutes.

Complete Equipment on Motor Trucks

A larger and more powerful outfit using a 7½ in. cutting tool and capable of extracting cores 6½ inches in diameter, is owned by the Pennsylvania State Highway Commission, and comprises a Calyx core drill, large water tank, gasoline engine, and a small hand pump mounted on a two-ton motor truck. This equipment is shown in action on the William Penn highway between Easton and Bethlehem, Pa., in the illustrations.

As shown in Fig. 1, the drill has just been started, a two inch oak board with a hole slightly larger than the cutting tool being used to guide the drill when starting the hole and a stream of water from the square tank on the truck is led to the hole through a short hose and serves to wash away the cuttings from the working face of the bit. Fig. 1 also illustrates the drill in action after the hole has been started.

In Fig. 2 is shown a view of the bit or cutting tool used in extracting the cores and to the right of the bit is a core which has just been taken out and is ready to go to the laboratory for testing purposes. The small hand pump on the left of the water tank is used to fill the latter when water under pressure is not available for the purpose. The equipment is therefore not limited to use in cities or towns, and can be easily moved from one locality to another many miles away on very short notice.

It is interesting to note that the actual time required for coring a pavement or road bed is, to some extent, an indication of its wear resisting qualities, but so far sufficient data has not been collected to accurately determine just how far the drilling time may be taken as an indication of the probable durability of the pavement being tested.

The test pieces secured with these outfits are in splendid condition for carrying out compression and abrasion tests. Many samples which have been tested, show a compression strength of 3000 pounds per square inch for three or four year old pavements made with a mix of 1 : 2½ : 5. The borings taken from the pavement are also of considerable value in furnishing an exact record of the thickness in different places, and also show how thoroughly the concrete was mixed at the time it was laid.

Greater Output of Stock Brick

New Methods Increase Production of Soft Mud Brick from 12,000 to 30,000 Per Day

THERE has been rapid advancement made in the manufacture of soft mud or stock brick during the last 10 or 12 years. It might be said that the advancement has been wonderful, graduating from the open or sun drying yard to the present steam dryer yard with plants 300 days in the year instead of only 100 days a year, as formerly. Some of the practical points to observe in the manufacture of this type of brick were outlined in a paper read before the Canadian City Products Association by Wm. Burgess of the Don Valley Brick Works, Todmorden, Ont.

In place of digging the clay by hand during the winter and letting the frost disintegrate it until summer comes, it is now dug with a modern steam shovel, dumped into a granulator or pug mill, and made into brick in a few minutes after leaving the clay bank. This method of working the clay has demonstrated conclusively that the extra pugging has made a marked improvement upon the brick, wherever it has been tried.

Greater Output Now Possible

In some plants in Canada the bricks are conveyed to the dryers on a cable and set off on pipes to dry. Other plants use rack cars on which pallets with brick are loaded on cars and placed in dryer tunnels, the drying taking from 24 to 36 hours and I have heard of some drying in less time. These systems have been found very satisfactory, and where it took 7 or 8 men to make 12 to 15 M. per day, the same number of men can now make from 30 M. to 35 M. in 8 hours, and I have seen machines making as many as 50 M. in 8 hours with 4 men, and I venture to say that better bricks are made to-day than formerly were made.

In place of burning them in scove kilns, as was done a few years ago, they are now burned in down-draft kilns of large capacity. They are also burned in continuous kilns with a large percentage of face brick and no arch brick, as formerly got in scove kilns.

Gathering the Clay

Human labor has its advantages. But the shrewd business man never depends on it when he can obtain mechanical devices to do his work, because he knows that man power cannot compete on a cost basis, nor on a time basis, with mechanical means. The old-fashioned way of getting out clay for soft mud brick manufacture was the laborer behind a pick and shovel, digging clay during the winter months when it was frozen, wheeling it into a pile to freeze more, believing that to be the only way by which he could make soft mud brick with it. That was a slow and expensive method.

I believe the best clay digger is a steam shovel, when you have a clay bank of the best working height. I find a clay bank best to work at all times, should not be more than twenty feet high when you are operating a steam shovel. Twenty feet is a convenient height of bank to work at all times, and more especially in hard freezing weather, because you can strip a piece off the face of your bank each day and reach from bottom to top without leaving a lot of frozen clay above the height of your boom reach as you would have to do if you had a higher bank. If you have any loam or sand on top of your clay, it pays to have it thrown down over your loose clay at night when it is freezing.

I would say that clay dump cars holding from one to two yards of clay are a very convenient size of car for an ordinary sized yard, but be sure and have the rails at least 30 lb. per yard, as a great deal of valuable time is lost through having too light a rail. The kind of power used to haul the cars depends on the layout of the yard.

Pugging the Clay

What do we expect the pug mill will do? We want it to work up the clay into a tough, plastic state. This cannot be done by simply cutting the clay up and adding water to it, and have each knife simply pushing it along so that the other knife can reach it and do the same thing. This is not pugging—only turning the pug mill into a conveyor.

In order to pug clay, it must be squeezed into itself. To do this while passing through the mill, there must be places where it is retarded or made to travel slower than other places so the clay where it travels fast will overtake and press into the slow travelling clay. This can be done in different ways, such as having the knives set so as to press down as well as forward, and by having straight knives at intervals. The same results can be obtained by having every other knife half worn out or short, the next knife, being long, pressing the clay past the short one.

Some pug mills have an adjustable slide at the discharge so as to retard the clay. It is a good way, but two or three more short knives on the end of the shaft answer the same purpose. Successful pugging does not depend on the length of the mill so much as to how it pugs. Long pug mills, when they are made to work more like a conveyor than a pug mill, will not do as good work as a short pug mill made to work properly.

Replacing Knives

It is not good to retard the clay too much, as that puts undue strain in your gear and shafting. When the belt commences to slip, provided it is reasonably tight, that ought to be warning enough. We ought to know that, when the mill commences to fill up so that the knives are getting worn, new knives should be put in at once. It is a good practice to put in a part of the knives new at a time; this is better than putting in all new knives at one time. The clay should be supplied through the pug mill in quantities to suit the capacity of the machine, not too fast so that it will arch over, or too slow as to cause your machine to run empty.

I think one of the greatest helps to pugging any clay is rolls, straight face if there are no pebbles, and conical rolls if pebbles or small stones are present. If there are no pebbles, conical rolls will also do the work. Have the face of your rolls good and true, set to run about ¼ in. apart so that they will give the clay a good squeeze in passing through.

It is desirable to have a good reliable man on the pug mill. There are no mysterious secrets about letting in enough water to make your clay work right on the machine, but you will require a man of ordinary intelligence who will pay attention to his work.

Machining

The machine end is only secondary after you have pugged the clay properly. There are several good types of machine for the making of soft mud brick, making all the way from 20 M. to 50 M. per day of eight to nine hours.

Drying

Drying the brick comes next in importance to pugging the clay. Some of the main points in a perfect dryer are summed up as follows:

(1) Flow of air to be proportioned so that drying takes place at top and bottom of tunnel equally.

(2) Keep the temperature difference between top and bottom of tunnels down to a minimum.

(3) Have every cubic foot of warm air do its duty by coming in contact with as much "moisture imparting" material as possible.

The ideal dryer is one of the long tunnel type, where the bricks gradually move from the loading end to the discharge end, and have the air enter the tunnel in as dry a state as possible for its temperature, and have it leave the dryer in as highly a saturated state as possible. Taking into consideration the decrease in temperature between the in-going and the out-going ends, which should be kept at a minimum, in order to have the air absorb a maximum amount of moisture, it must come in contact with as much of the brick to be dried as is possible, for air takes up moisture by convection, and the currents of air must be broken up as much as they can be by the brick to be dried without retarding its even flow. It takes time to get your driers right, which can be solved by individual treatment and a long and varied experience. Take, for example, in a tunnel drier, where sometimes the air is compelled to move a distance of 100 feet in a horizontal direction, the difference in temperature between the bottom and top of the tunnel is sometimes as much as 10 to 15 degrees F. hotter at the top than at the bottom of the tunnel, consequently, the brick will dry faster at the top than at the bottom of the tunnels. Due consideration must be given to the cooling surfaces of the tunnel, that is, the roof, side walls and ground.

The reason why some bricks are harder to dry than others is owing to the fact that there is a difference in the ease with which the water they contain can be removed by evaporation. The drying of soft mud brick by the waste heat process is a comparatively simple proposition provided your clay is anywhere near the average in quality as to plasticity, porosity and moisture, and does not come under the class of tender clay. The drying of tender clay, however, is a much more difficult problem. While the builder of your drier must make special provision for the handling and drying of your particular product, much more depends upon your own careful handling of the means placed at your disposal. Necessarily it takes longer to dry brick made of tender clay, and the expense, is, therefore, greater, but the careful brickmaker soon learns the peculiarities of his clay and tempers his heat so as to get the most satisfactory results. It is sometimes necessary in handling tender clays to add a proportion of sand with the clay to make them less liable to crack in the process of drying.

Kilns

All kilns should be filled to capacity and as nearly as possible up close to the crown, and the setting so arranged that the ware may be burned evenly, without spending too much time in "soaking." Much valuable kiln space is lost and much fuel wasted in not filling the kiln to capacity. Experiment to see how high your ware can be set with good results. Set ware well over flue openings, close up to the walls to prevent short circuiting from bags. Do not set wet or partially dried ware, as this practice lengthens the time of burning and increases the fuel consumption. If the kiln is not a good drier, run peep holes through the kiln near the floor in order to determine during the burning how the different parts heat up. The more uniformly a kiln gains heat, the less fuel will be required,

It costs a great deal more to equip a soft mud plant to-day than it did 15 years ago, but unless you equip your plant right up to date with steam shovel, granulators, conical rolls and proper pug mill and machine, cars, good pallets, proper tracks and a good type of dryers, and take your clay direct from bank to machine, your competitor will get ahead of you.

Go out and see what the other fellow is doing and go him one better. I firmly believe that soft mud brick will continue to hold their place in the brick world, in spite of all other processes which has come against them.

Legislation for B.C. Engineers

A score of engineers headed by Mr. E. G. Matheson, of Vancouver, with Col. H. S. Tobin as counsel, waited on the private bills committee of the B. C. Legislature, recently, in support of the bill to incorporate the professional engineers. They met some opposition from the B. C. Land Surveyors, who were represented by H. A. Maclean, K. C., accompanied by Mr. Drury, the president of that organization. Their principal objection to the engineering bill was that it would prevent land surveyors who went into a remote part to survey mineral claims from advising as to the development of these claims. This, they argued, would impose a great hardship on the claim owner, as he would have to employ two men where one formerly did the work.

The private bills committee has decided to recommend the bill to the House with amendments covering all objections.

Community Heating Coming to Practical Issue

Central Plant is Considered by the Author as Solution of House Heating Problem—Types of Heaters for this Purpose

By Francis J. Hyde*

AT the present time with the labor unrest, high prices and shortage of coal, and also the possibility of the anthracite coal mines running out in the course of a few years, the people of Canada, more especially of Eastern Canada, have started to worry as to the heating of their homes. In the opinion of the writer, however, there is no cause for concern, as community heating is bound to come to a practical issue, just as houses have been wired for lighting, and piped for gas for domestic purposes, or as water is now supplied in abundance by the simple turning on of a tap. All homes in the course of time will be connected to a central heating plant and will be heated and kept at any degree of temperature that is required by the simple expedient of turning on or off a valve.

Naturally the question will arise as to which is the best system to heat with—live steam, hot-water, or electricity—and how these systems can be installed economically. Live steam has one advantage, namely, it will heat a building very rapidly, but on the other hand it is very hard to control the temperature in a room where a steam system has been installed. The room is generally either too hot or too cold, but to offset this there are many devices now manufactured which certainly control the temperature, but they are not economical of live steam.

As electricity is prohibitive on account of cost, we have to deal with the hot water system for community heating which has the advantages of giving a more uniform heat, of being easily controlled, of being most economical, cleanest, etc.

A Central Source of Heat

Suppose you should be living in a locality in which there are 50 homes to a block. You must agree that it would be very nice if one fire or a central heating plant could heat all these homes without the fuss of getting in coal, or having a man entering your house twice or more a day to look after your heating, not to speak of the dirt from gas fumes, soot and ashes, and also the storage room you could save, now taken up by coal bins.

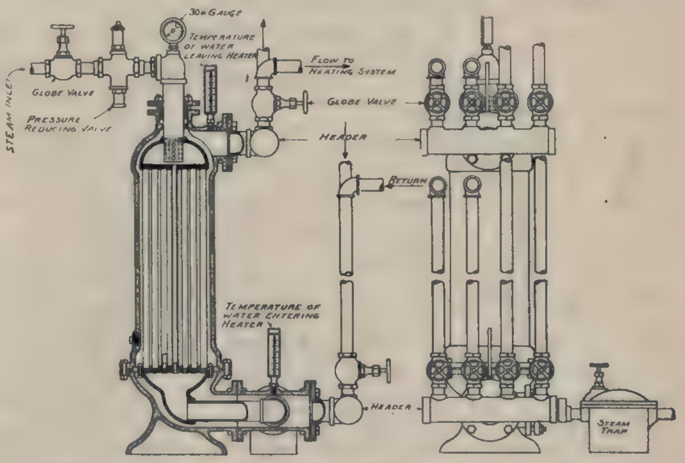
The average city home of 7 or 8 rooms with basement requires from 8 to 10 tons of anthracite coal to keep the home heated throughout the winter. At that rate 50 homes will consume 500 tons per year, which at $12.00 per ton shows a bill of $6,000; the hire of 4 men at $3.00 per week for 50 homes for 6 months only gives a figure of $3,600; with gratuities it is within reason to state that it takes $10,000 to heat these 50 homes for one winter season or an average of $200 for each home. In the case of flats heated by the landlords, by installing the system as mentioned above they would get equal benefits which will amount to 50 per cent. in cash, outside of cleanliness and having contented tenants, with almost no repair bills for the heating system.

Now another fact is that by the installation of central heating plants properly equipped, any grade of cheap fuel could be used to raise low pressure steam, and one or two men could easily look after the fires in, say, 4 plants without being overworked. The fires could be centralized which naturally would reduce fire risks, and also greatly reduce insurance rates.

The sketch below shows how easily community heating could be accomplished by the piping of steam from a central heating plant to each household. Its simplicity will appeal to all interested in the housing question.

Evolution of Heaters

When the first so-called heaters were put on the market, they were of a cylindrical shape placed horizontally, made to contain much of the circulation water which was heated by steam injected into iron pipes or sometimes brass pipes. Although these "heaters" were very slow in operation and were more of a tank than a distributor of heat, they met with good success in large buildings, but showed poor economy in comparison with the then existing coal furnaces. It was also considered a good improvement on the live steam heating by doing away with the clanking noise of the radiators when the steam valves were opened. Later on, heaters were made with a smaller volume of circulating water and more heating capacity. These proved a real success and gave better service when the new heater was placed vertically for the better outlet of condensed steam.



Pipe connections for hot water heater using low pressure steam

Then came many systems of forced circulation by means of steam pumps, and by means of turbines and vacuum pumps. These systems, with all their good points where gravitation could not be used, caused, and cannot do otherwise, an increased strain on the heater and also on the whole piping system. The heater in many cases was found to leak by these forced methods of circulation and the steam was then found flowing into the circulation water at the expense of the coal bill.

Of course, the strain caused by expansion and contraction tells more on a heater even than on a boiler on account of the constant differences of temperatures at every inch of metal inside and outside the piping of the heater. Let us say here that until very lately all the heaters had their pipes expanded at each end, the same as boiler tubes.

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*Managing Director, Montreal Machine Shop, Ltd.

Every engineer and practical man in the heating business knows that a first class reliable heater was never built to stand the constant strain caused by differences of temperature where cold water and steam meet instantaneously, therefore causing the piping and packing to give way in time. The more efficient the heater in service, the oftener the renewing of pipes and packing was necessitated.

Heaters Do Not Stand the Strain

It is a fact that the better the heater transmits its calories to the cold water the heavier is the strain on the heater; this has been the reason for many manufacturers diminishing the volume of steam into the heater, so that many of the heaters to-day are mere "condensers" and, as a consequence, the lower part of these "heaters" is cold and only the upper part, where the steam is still steam, has a real value as a heat transmitter. This was not a correction, nor yet, an improvement.

This being the case, no practical man has ever dared use heaters for community heating. Only large plants where repairs could be easily and often attended to were furnished with heaters.

An expert machinist with years of experience in heating apparatus repairs, has brought on the market a leak proof, strain proof, packing proof and, within reason, pressure proof heater, with abundant heating surface, being a heater from foot to head. The tubes are bolted at each end on upper and lower plates of domes, with all other connections emerized, so that no packing whatever is used. This new heater, called the "Economic" and patented in many countries of the world is now used in many large institutions where its value was demonstrated by a yearly saving of from 25 to 55 per cent. of fuel.

This heater is guaranteed against leaks from contraction or expansion for 20 years, can stand nearly twice the pressure of any high pressure boiler or any device with forced circulation. It is fool proof, quick and noiseless.

Such a heater has been installed in a Montreal institution and only one boiler is operated instead of two as previously. At another place, the daily coal consumption has been cut in half. A small institution in Quebec city by installing an 8 in. x 32 in. heater of this type, shows a saving of 30 tons of coal in a period of 60 days.

When this heater is used for domestic hot water service, or boiler feed water service, it has given excellent service as every calory of heat received in the heater can be transmitted to the cold water without any loss. It will work with any low pressure or reduced saturated steam.

This type of heater is specially adaptable to community heating, connecting to a source of low pressure steam. The illustration shows the arrangement of connections.

Quality of Sheet Asphalt Governed by Plant

First Class Construction Cannot Result from Use of Inferior Paving Equipment—Competent Inspection is Essential

A SHEET asphalt pavement is one having a wearing course composed of a mechanical mixture of asphalt cement with a carefully graded sand and a finely divided mineral filler, such as limestone dust. This mixture is commonly called topping or surface mix. Irrespective of the kind of foundation, the wearing course is ordinarily laid upon an intermediate course of asphaltic concrete called the binder. There are two types of binder known as open binder and close binder. The former, as its name implies, has a rather open or porous texture due to the fact that it consists of a single commercial size of broken stone, the fragments of which are coated and bound together with asphalt cement. Close binder, which is more commonly used, is composed of a mixture of broken stone, sand and asphalt cement, the proportion of sand being sufficient to fill the large voids in the stone aggregate thus producing a bituminous concrete of relatively close texture, which is more impervious and offers greater resistance to displacement than the open binder. The foundation is ordinarily newly laid Portland cement concrete although old pavements, such as brick, stone block, concrete and broken stone may often be utilized to produce satisfactory and economical results. In a recent brochure, issued by the Asphalt Association, some important features of sheet asphalt pavement construction are elaborated upon. From this pamphlet the following extracts are taken:

Serviceability of Sheet Asphalt

The sheet asphalt pavement, through many years of use, has successfully demonstrated its ability to meet the requirements of such wide variations in traffic and climatic conditions that it has become one of the most popular and extensively used types of pavement yet developed. So far its use has been largely confined to municipalities, but with the similarity in traffic conditions now commonly found between many state and county highways as compared with city streets its extensive use on main trunk highways is beginning to follow.

Certain merits which are ordinarily conceded to sheet asphalt as a city pavement are well worth consideration in connection with the utilization of this type for main trunk highways. Sheet asphalt is highly resistant to impact and abrasion under rapidly moving traffic. It offers very low traffic resistance and is highly sanitary as the surface is impervious and may be readily cleaned. It wears slowly and uniformly under traffic, and is easily repaired. After years of service, it may be resurfaced with less waste of existing material than any other type of pavement. It may be opened to traffic a few hours after construction.

Asphalt Paving Plants

A well equipped and scientifically operated paving plant is essential to first-class sheet asphalt construction and the use of inferior equipment in this connection cannot be too strongly condemned. The design of an efficient plant is no simple matter and the contractor is more apt to lose money than to save if, without previous experience, he attempts to install a plant by quickly assembling various units purchased from different sources or to utilize old miscellaneous equipment. Each unit of a plant bears a very definite relation to some other unit, both as to strength and capacity, and haphazard selection is apt to cause break downs or slighting of important details which interfere with the quality of output and may cause many costly delays. Complete installations are supplied by a number of concerns in three general types, the permanent, the railway and the portable or semiportable plant.

The permanent plant is mainly used in connection with the construction and maintenance of city pavements. As it is only to be used in supplying material for a restricted locality and portability is not a necessary feature, the settings are usually stationary and its design may involve heavier and more substantial equipment than for the other two types. The portable is of lighter construction and smaller capacity, and is constructed in two and sometimes three separate units to facilitate moving it from place to place. Modifications of this type equipped with permanent supports or foundations are known as semiportable. Railroad plants are of heavier construction mounted on railroad trucks and are operated at a railroad siding. Irrespective of type, a paving plant for sheet asphalt construction usually consists of the following parts operated as described.

Elements of the Plant

A power and heating unit is required to operate the machinery, dry and heat the mineral aggregate and melt and agitate the asphalt cement. An elevator, usually of the belt-and-bucket type, is employed to carry the mineral aggregate to a drier consisting of a revolving metal drum through which a constant stream of hot air or hot exhaust gases are forced. As it passes through the drum the aggregate is thrown about by means of baffle plates, so that it is not only heated by contact with the hot metal, but also dried by intimate contact with the hot air or gases. As control of the temperature of the mineral aggregate prior to mixing is a most important consideration a pyrometer should be installed at the discharge end of the drum to register the temperature of the mineral matter. The exhaust gases frequently remove considerable dust from the aggregate and are therefore sometimes passed through a dust collector. When running topping, composed of a mixture of two or more sands, it is customary to feed them simultaneously to the drier in the proper volumetric proportions, measurement being made by shovels. In the case of binder stone, however, which is to be mixed with sand, the two materials should be heated separately or screened after heating and combined in the mixer. This is desirable because of the tendency of the coarse aggregate to segregate from the fine during its passage through the drier. From the drier the heated aggregate is elevated to hot storage bins from which it is discharged into a measuring or weighing box before being introduced into the mixer.

Melting and Fluxing

The asphalt equipment consists of one or more tanks usually supplied with hoists or lifting devices. Here the asphalt is rendered fluid by the application of heat and sometimes fluxed to desired consistency. If fluxing is involved, a tank for holding flux oil should also be included in the plant equipment. Melting and fluxing tanks are heated either by direct fire or by means of steam coils, preferably the latter. They should be provided with an agitating device to prevent settlement of any non-bituminous constituent which may be present and to assist in fluxing. Agitation is usually secured by means of steam or air jets forced up through the heated material from perforated pipes placed near the bottom of the tank. Each tank should be provided with an accurate stationary thermometer for recording the temperature to which asphalt and flux are heated. When the fluxing process is used a measured or known quantity of refined asphalt, too hard for direct use, is placed in the melting or fluxing tank, where it is heated to a fluid condition. A pre-determined quantity of hot flux is then run in and the contents of the tank continously agitated until an asphalt cement of uniform consistency is produced. When steam agitation is used special care is required to prevent condensation before it is injected into the asphalt or troublesome foaming will result. After melting or fluxing, the asphalt cement is maintained at the proper temperature until used in the mix. It is usually lifted by a special device directly from the melting or draw-off tank to a weighing bucket which empties into the mixer.

Final measurement or proportioning of the constituents of the mix is conducted from a mixing platform set above the mixer. The mixer commonly consists of an iron box equipped with a double set of blades revolving on two horizontal shafts extending through the box. These blades are so set that the mixture is continually tossed upward and at the same time worked toward the centre of the mixer. The mixer is provided at the bottom with a sliding discharge gate, which is controlled by a lever and through which the hot mix is allowed to drop into wagons or trucks for delivery at the site of work.

Operation of Plant

As it is necessary that plant operation and construction work proceed simultaneously and regulate one another to a considerable extent, it is desirable that the paving plant be located as near as possible to the site of construction. Asphalt mixtures must be delivered on the job at such temperature that they may be readily spread, and as they set up upon cooling the plant should produce and deliver mix no faster than and only at such times as it can be immediately laid. On the other hand, the plant's output capacity is known and, as construction work is planned accordingly. the plant cannot at will work intermittently without seriously interfering with the construction work and causing unnecessary delay and expense. Moreover, the behavior of the mix when being spread and compacted, may indicate the desirability of slight modification in proportions which are allowable under specification requirements.

Inspection of Sheet Asphalt

Competent inspection of both plant operation and street work are very necessary to successful sheet asphalt construction. This will ordinarily necessitate the services of two inspectors who have acquired sufficient experience to suggest modifications in proportions or methods of manipulation, within specifi-

No. 10

Canada's Contractors—H. B. MacConnell

Major H. B. MacConnell, who is associated with Mr. W. Hicklin, whose biographical sketch appeared in last week's issue, was born in Springbrook, Ont., in 1886 and lived there until 1906. He has been engaged in the contracting business ever since 1908, in which year he obtained his first contract on an extension to the Central Ontario Railway. Since that time, Mr. MacConnell has been connected with all classes of contracting work, specializing, however, in concrete construction. Prior to the war, he was engaged in and about Ottawa, Ont., building in Ontario County alone about 40 reinforced concrete bridges. He also did considerable concrete road and street construction and built a number of sewers. He was also interested in the industrial field to some extent and has to his credit the erection of several large buildings. In 1914 Mr. MacConnell enlisted and shortly after demobilization in 1918, formed a partnership with Mr. W. Hicklin, under the name of MacConnell & Hicklin. This firm specializes in road building and last year successfully completed 14 miles of macadam highway for the county of Haldimand, Ontario. A description of this contract and the interesting methods involved on it appeared in the Contract Record of Sept. 10, 1919. The outstanding feature was the adoption, by the contractors, of motor trucks for road material haulage; the success with which the innovation met proving that road construction, especially where long stretches are concerned, can successfully employ efficiency methods just as well as building construction. So well was this contract completed that the county of Haldimand has given this firm another contract for completion this year. This contract involves a longer stretch of road of the same general character.

Major H. B. MacConnell

cation limits. which from time to time may be desirable. These plant and street inspectors should work in harmony and keep in close touch with one another. The former should occasionally visit the street in order to observe how the mixtures behave during laying.

The plant inspector should carefully observe all details of plant operation, particularly in connection with the heating of individual constituents, their measuring and proportioning, the period of mixing, and the condition of the mix upon leaving the plant. He should keep a record of the temperatures to which the asphalt, sand and stone are heated prior to mixing and the temperature of the finished mixture when discharged. He should also record the number of loads sent out. He should test and record the consistency of the asphalt cement, particularly if fluxing is carried on at the plant, in which case he should see that the proper proportions of refined asphalt and flux are used and that a uniform product is obtained. He should make grading tests of the mineral aggregate constituents and see that at all times proper proportions of asphalt cement and aggregate are used. He should check measurements from time to time, and should make occasional pat tests of the surface mix as it is being prepared. He should be provided with the necessary equipment for plant testing and a room in which such tests may be made. In addition to his own tests he should, however, forward to a testing laboratory samples of the various constituents and of the mix itself for check and control tests. The testing equipment of the plant inspector will ordinarily include the following:

An armored thermometer of suitable range for recording temperatures of the hot aggregates and mixes.

A set of standard screens and sieves, as may be called for in specification requirements.

A stiff brush for cleaning sieves.

A large balance of ten pounds pan capacity and a set of decimal weights for broken stone weighings.

A small sand balance with pan capacity of 200 grams for weighing sand.

A complete penetration test outfit for determining the consistency of asphalt cement.

A pat test outfit.

A supply of report forms.

The room assigned to plant testing should contain a short work bench for testing apparatus, shelves for samples, a chair and a table. For sampling, the inspector should be provided with suitable cans, gum labels, pans and a long handled metal dipper.

Duties of the Street Inspector

The street inspector should carefully observe all details of the laying of the pavement. He should take and record the temperature of the various loads of hot mix received on the work and for this purpose be provided with an armored thermometer. He should see that the loads are so distributed as to give the specified thickness of pavement and that they are properly raked and compacted. He should take occasional check samples of the mix as received and forward same to the testing laboratory and, in some cases, it may be advisable for him to take samples of the finished pavement for laboratory analysis and density determinations.

A properly constructed sheet asphalt pavement wears very slowly and uniformly under traffic which accounts for its long service record. Fast moving rubber tired vehicles produce but little noticeable wear and in fact the pavement often appears to improve under such traffic provided the grading of the aggregate and the consistency of the asphalt have been judiciously controlled. The kneading action of such traffic. if concentrated, together with the mist of oil from the exhaust of motor-driven vehicles combine to consolidate and enliven the surface until it has almost the appearance of a dense rubber mat. Accumulations of oil drippings from standing vehicles if allowed to collect in excess will, however, soften the asphalt to such an extent that disintegration will follow. Such accumulations should not therefore be permitted to occur. Gas leaks will also cause disintegration by similar action. Some traffic is essential to the long life of the pavement as an untraveled street tends to harden more rapidly with age than one being constantly kneaded by traffic, and cracking follows with accompanying disintegration due to frost action.

If a hole or depression occurs in the pavement it should be promptly repaired, but the cause of the failure should first be ascertained. Thus if disintegration is due to a gas leak a patch affords but temporary relief unless the leak is first stopped. In like manner failure due to poor subgrade or foundation conditions or to breaking up of the binder cannot be permanently remedied by patching the wearing course only.

Making Patches

Patches should be made by cutting out the unsatisfactory portions of the pavement for the full depth of disintegration so as to produce excavations with approximately vertical sides. The excavation should then be thoroughly cleaned and refilled with suitable material as in original construction. Such patches should always extend through the entire thickness of binder as well as the wearing course. If the pavement is old and very hard the sides of the excavations are sometimes lightly painted with hot asphalt cement to insure a good bond between the old pavement and the patch.

Should a narrow crack appear in an asphalt pavement it should be left alone until the edges begin to disintegrate and wear away. A patch may then be made by cutting out the pavement on both sides of the crack and filling with fresh mix which should be thoroughly compacted. Great care should be exercised to obtain a well-bonded joint or two cracks, one on each side of the patch, are likely to develop in place of the one original crack.

When a sheet asphalt pavement is laid adjacent to car tracks, excessive vibration may cause an opening between it and the rails, which allows entrance of surface water. Such trouble should be remedied by cutting back the pavement for a sufficient distance to insert three or more courses of brick or block. The pavement is then brought flush with the block by the addition of new material which should be thoroughly compacted.

Re-surfacing

When a sheet asphalt surface has become so old and worn as to require renewal the surface heater method of resurfacing has been found the most satisfactory. The surface heater consists of an apparatus for bringing hot air or superheated steam into contact with the pavement until the old mix has been softened to the required depth, usually from ¾ inch to 1 inch. All burned material is then removed from the heated area and immediately replaced with fresh hot mix. which is spread and compacted as in original construction. Immediate replacement is absolutely essential and poor results will follow delays, which permit the surface to become chilled or dirty before the new material is spread. Such method of repairing should of course be limited to cases involving failure of the wearing course only, in which disintegration has progressed from the top down and not from the bottom up. Excessive waviness or disintegration resulting from sub-surface conditions should be remedied by relaying the pavement.

Mainly Constructional

East and West—From Coast to Coast

The electrical warehouse of the Dominion Steel Corporation's plant at Sydney, N.S., was completely destroyed by fire recently. The loss is estimated at $100,000.

The bricklayers of St. Thomas, Ont., have reached an agreement with their employers on the salary question. After May 1 they will receive $1 an hour for a nine-hour day.

The building trades workers of Edmonton, Alta., in an appeal made recently to the Provincial Government, ask that wages be adjusted every two months to keep pace with the increasing cost of living.

The plant of the Tilbury Brick and Tile Company, of Tilbury, Ont., suffered damage to the extent of $30,000. by a fire which occurred recently. Mr. H. H. Hallatt, president of the company, announces that the plant will be rebuilt at once.

The Western Ontario delegation to the International Deep Waterways Convention at Buffalo, N.Y., was composed of. Mayor E. S. Little, London; Mayor John R. Eden, of Kitchener; J. F. McLure Sclanders, secretary of the Border Cities Chamber of Commerce; T. J. Hanigan, of Guelph, and ex-Mayor Horton, of St. Thomas.

The executive of the Department of Architecture, University of Toronto, has arranged a series of lectures by prominent architects. Among those who will lecture are A. F. Dickson, Royal Architectural Institute of Canada; H. E. Moore, president of the Ontario Assoc. of Architects, and Thomas Adams, Town Planning Adviser of the Commission of Conservation.

The Vancouver and Districts Joint Sewerage and Drainage Board, Vancouver, B. C., decided at a recent meeting to appropriate $50,000 of the funds from the new bond issue for the reclamation of the Burnaby Lake area, which includes Deer Lake area, Still Lake and Brunette River. The Board's engineer was given instructions to prepare a report detailing the work necessary on this project.

The election of officers of the Saskatchewan Land Surveyors' Association for the year 1920, which was held at the closing session of the Association's convention in Regina recently, resulted as follows: President, D. Alpine Smith, Regina; vice-president, J. Lonsdale Doupe, Winnipeg; secretary-treasurer, H. S. Phillips, Regina; councillors, J. E. Underwood, Saskatoon, and S. Young, Regina; auditors, Begg and Murray, Regina.

The builders, contractors and building supply dealers of Moncton, N.B., have formed a Builders' Exchange. This is the first city in the province to form an organization of this kind, and it is anticpated that much good will be done by the exchange in improving the housing situation. The following officers were elected: Eli Brooks, president; Charles H. Wheeler, vice-president, and Ambrose Wheeler, secretary-treasurer.

The Imperial Tobacco Company's plant at Leamington, Ont., will shortly be ready for occupation. The building is of steel and concrete construction, 273 x 112 ft. and fireproof throughout. Every consideration has been given the interior construction to the convenience of the employees; cloak rooms, wash rooms, lunch and rest rooms being provided, each fitted with the most up-to-date equipment. It is estimated that ample room will be available in the basement for the storage of 2,000,000 lbs. of tobacco. The cost of the building and equipment is in the neighborhood of $200,000.

At the second annual convention of the Dominion Public Works Federation of Canada, held recently, at the Russell Hotel, Ottawa, the officers for the ensuing year were elected. They are: President, T. G. Matheson, Toronto; first vice-president, F. Jacques, Ottawa; second vice-president, A. Morrison, Montreal; third vice-president, F. C. Davey, Winnipeg; secretary-treasurer, S. McGarry, Montreal; assistant secretary, J. H. Rogers, Toronto. The executive committee will be composed of the elected presidents of the affiliated associations.

At a convention of the Housing Commissions of Western Ontario, held recently in London, the Western Ontario Housing Commissions Associations was formed and the following officers elected: Chairman E. R. Dennis of the London Board, president; vice-president, Mr. Gundy of Windsor; secretary-treasurer, S. Baker of London. Executive—Messrs. Denton of Tillsonburg and Mason of Ingersoll. The cities enrolled are: London, St. Thomas, Woodstock, Sarnia, Windsor, Stratford, St. Marys, Ingersoll, Tillsonburg and Walkerville. The purpose of the organization is to uphold the present Housing Act. Acting on a recent report that the Drury Administration intended rescinding the present system of government aid, the association decided at the convention to send a delegation to the Government to urge continued activity under the present scheme.

Personal

Mr. Alcide Chausse, architect, of Montreal, was re-elected president of the American Society for Municipal Improvements at the convention held at Buffalo, N. Y.

Mr. Geo. D. Mackie has been appointed representative for the city of Moose Jaw, on the commission to investigate the Saskatchewan river water supply scheme.

Mr. W. Bruce Riddell, of Hamilton, is the winner this year of the Boston Society of Architecture's special prize for proficiency. Mr. Riddell is taking a post-graduate course at the Boston School of Architecture.

Mr. R. D. Waugh, who has been appointed to serve on the Sarre Valley Commission in Germany, representing the British Government, will leave Winnipeg on March 17, and sail from New York March 20.

Mr. J. Clarke Reilly, Secretary of the Association of Canadian Building and Construction Industries, will, within the next few weeks, open a permanent office in Ottawa. Mr. Reilly's present headquarters is at 65 Victoria St., Montreal.

Mr. J. P. Howe, of Pembroke, Ont., has been appointed town engineer of Arnprior, Ont., succeeding Mr. J. W. Moore, who resigned recently to accept the position of county engineer. Mr. Howe is a graduate in science of McGill University.

Mr. B. H. Dowler was appointed Road Superintendent of Gloucester County, Ont., at a recent meeting of the Township Council. Mr. Dowler will have five foremen under him, one in charge of each of the five divisions into which the township is divided.

It is reported that Mr. L. K. Jones, Assistant Deputy Minister and Secretary of the Department of Railways and Canals, Ottawa, will retire on April 1. Mr. Jones has been connected with the department for 30 years; age and ill-health are given as the reasons for his retirement.

M. Jones, city engineer of Port Arthur, Ont., has been appointed engineer to take charge of all the Toronto work of the Warren Bituminous Paving Company, and will enter upon his new duties on the first of next month. Mr. Jones came to Port Arthur in 1906 from Winnipeg, and held the position of assistant city engineer until 1911, when he was appointed city engineer. Among his most important undertakings was the installation of the new waterworks system at Port Arthur and the building of the Algoma Street and Black Bay concrete bridges.

Mr. Charles W. Tarr, vice-president and general manager of Messrs. Morris Knowles, Limited, engineers of Windsor, Ont., will shortly go to Elyria, Ohio, where he will be engaged in a large engineering undertaking for the firm of Morris Knowles, Incorporated, the American organization. Mr. Tarr was born in Lawrence, Mass., and has been connected with some of the largest engineering prospects in America. He has been with the Canadian firm of Morris Knowles, Limited, since its incorporation, and was engineer of the Essex Border Utilities Commission. Among his engineering undertakings while in Canada are: The construction of an intercepting sewer system, some five miles in length, for the Essex Border Municipalities; and the designing of water purification plants for Ojibway and Amherstburg. Mr. Tarr is a member of the Engineering Institute of Canada, American Society of Civil Engineers, Border Chamber of Commerce, Detroit Engineering Society, American Waterworks Association, and the Town Planning Institute of Canada.

Obituary

Mr. W. Norcross, a well-known building contractor, died on February 27th at his home, Worcester, Mass., aged 81. He was a member of the firm of Norcoss Brothers, which had a Canadian branch, and which is now consolidated with the Montreal firm of Anglin-Norcross, Limited.

The death occurred, on March 1st, after a brief illness, of Mr. W. E. Potter, head of the firm of W. E. Potter and Company, painters and contractors, Montreal. Mr. Potter, who had engaged in this business for the past thirty-five years, was a member of the Montreal Builders' Exchange.

Mr. J. W. Arthur Kirk, of Ottawa, died recently after a short illness from pleuro-pneumonia. Mr. Kirk was manager of the Ottawa Cut Stone Company since that company's incorporation six years ago, and, prior to that, had been engaged in the stone contracting business in Ottawa.

Mr. Wm. McGill, well-known contractor of Hamilton, died in that city recently. Mr. McGill was born in Guelph, Ont., 71 years ago. He had been a resident of Hamilton for the past 50 years and had been connected with many large construction jobs, among which was the building of the present city hall, while with the Pigott firm, after which he went into business for himself as a wrecker.

Trade Incorporations

Machinery & Foundries, Limited with head office at Brockville, Ont., capital $250,000.

British-Canadian Machine & Tool Company, Limited, with head office in Toronto, capital $500,000.

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Ventilation on Proper Principles is Important Industrial Adjunct

PROPER ventilation, there can be no gainsaying, has a vast effect on all human effort. Particularly among workers, any improvements in a system of ventilation contribute materially to an increase in their strength and energy and in the quality and quantity of their output. The close relation between the health of workers and the results of their efforts has been very clearly recognized by public officials and sanitarians for many years, but more recently employers and employees, themselves, have come to understand the benefits that accrue as a result of more sanitary and health-producing working conditions. Consequently, we are seeing factory surroundings improving to such an extent that workers remain longer on the job and there is a greatly lessened labor turnover, quite aside from the improved nature of the work performed.

We are constantly learning more about the principles of ventilation with the result that we are now more than ever able to suggest measures that will improve the environment and surroundings of industrial workers. Certain fallacies have always existed in regard to ventilation, but, thanks to a newer knowledge, we are on the way to correct our misconceptions. What this newer knowledge of ventilation is and how its application will better the status of our industries, is described in an excellent article in this issue by Dr. George G. Nasmith, C.M.G., entitled, "Recent Advances in Science of Ventilation from the Industrial Standpoint."

In this article, the author, one of Canada's most eminent sanitarians, points out that proper changes in the systems of ventilation in many industries will bring about beneficial results in the health and efficiency of the workers and in their output of work. Dr. Nasmith describes what he calls the newer knowledge of ventilation. He shows that symptons arising in vitiated atmospheres are due to heat stagnation in the body and that the moisture of the atmosphere, its temperature and its stillness are responsible for the effects produced. When air is constantly stirred up, or the temperature is kept low, no harmful effects are apparent even though the carbon dioxide content has increased to many times its normal amount and the oxygen content greatly reduced. The evil effects consequent upon working in stagnant air are due, as he states, not so much to the increasing volume of impurity as to the fact that no measures are provided for the relief of the rises in body temperature. It is this increase in body temperatures that impairs the inclination to do physical or mental work.

The solution of the ventilation problem, then, is a matter of providing low temperature, low humidity and motion. The ideal system of ventilation should, therefore, accomplish several things. "It should first of all maintain the air at a proper temperature and humidity; it should keep the air in gentle motion; it should remove contaminating substances and should provide a certain quantity of fresh air to remove all products of respiration." Since there are practical mechanical means of controlling and modifying these factors at will, there is no reason why we cannot live indoors under conditions which at least approximate the ideal.

The article referred to goes into the subject in more exhaustive detail and we recommend our readers, especially those who are concerned in the welfare of workers, to take to heart some of the ideas therein contained and apply them so that the health and efficiency of the employee, whether in office, warehouse or factory, will be improved.

Four and a Half Millions Recommended for Montreal Aqueduct

IF the recommendations of the Montreal Administrative Commissioners are agreed to, the aqueduct will be improved at a cost of $4,500,000.

Messrs. R. S. & W. S. Lea, consulting engineers, reported at length on the question of enlarging and utilizing the aqueduct, and the following recommendations are in accord with their report: (1) That the aqueduct be completed for water supply purposes only at an estimated cost of $1,683,000; (2) that a new motor driven low level pumping plant be installed, at an estimated cost of $850,000, operating on electrical power purchased from the Montreal Light, Heat & Power Company; and that the equipment in the present steam plant be eventually disposed of; (3) that the rated capacity of the water filtration plant be increased to a total of approximately 120 million gallons per day, at an approximate cost of $2,000,000. The consulting engineers referred to the Laurentians as a source of water supply, but unfavorably on account of the cost. The city will have an abundant water supply from the St. Lawrence by the aqueduct canal.

Ex-Director of Housing for Quebec Defends Old Policy

DR. E. NADEAU, who resigned as provincial director of housing for Quebec, has come out with a vigorous defence of the original housing plan which was recently thrown overboard by the government as being too complex. On the city of Montreal he places the blame for the abolition of the technical commission, which had charge of the housing programme.

Dr. Nadeau takes exception to the amendments by which houses can be sold, thus importing the element of speculation into the scheme; to the demand that Montreal should be withdrawn from the jurisdiction of the commission; and to the amendment permitting three storey flats to be built, it being obvious, says Dr. Nadeau, that this opens the way to abuse, since favored individuals can put up the houses, live in the ground flat, and rent the upper two for a sufficient profit to be in a rent-free condition themselves. It was never intended that the public money should be used to benefit one individual at the expense of two others. "These demands have been incorporated in the amendments to the law and the most unfortunate feature is that this has to be approved by the federal government in order to get the Province's share of the money. If the amendments are not approved, which I fear may happen, they will either have to be withdrawn or federal aid for housing in Quebec will be held up altogether, unless the provincial government decides to lend the money only to cities and towns that are not anxious to build 'three deckers.' "

"I am sure of my ground," continues Dr. Nadeau, "but if they could have shown me where I was wrong, I would have been satisfied. On the contrary, I was never given an opportunity of demonstrating that my programme was sound, even although the province did not stand to lose a cent of money, and I was unable to convince the ministry because the subject was never approached with an open mind or with a desire to be convinced. At the same time what has been done is done, and my only interest is that the housing project should still be made a success. If the government distributes the federal money at its disposal with promptness I am sure that sufficient results can still be obtained to prove that good houses pay not less than good roads."

Sherbrooke Concern to Manufacture Steam Power Equipment

George L. Dourne and F. A. Schaff of New York have recently acquired the Campbell-Howard Machine Company, Limited, of Sherbrooke, P. Q. This new firm will continue to operate under the name of the Sherbrooke Ironworks. Special machinery will be installed for the manufacture of locomotives, marine and stationary super-heating apparatus, together with other steam specialties.

Highway Construction Under Present Conditions

Editor, Contract Record:

"Engineers are fully convinced that under normal conditions, expenditures for good highways are investments that yield satisfactory returns to the public but when costs have risen abnormally, the investor must consider alternative plans for accomplishing the desired results. Last year we had to acquire the habit of considering $40,000 per mile as the proper cost for a road that could have been built for half that sum before the war. This year, if the bids received are a fair criterion, we must decide to pay $60,000 for the identical product. Against an annual interest and amortization charge of $2233 (interest at 4½% and amortization in 15 years) we now have an annual charge of $6700, three times as much. No highway engineer who has any sense of values and the significance of figures can fail to set against these annual charges, the cost of maintaining a cheaper type of pavement, even though he knows maintenance costs too, have gone up. Already there is much talk of serious curtailment of highway programmes until costs come down to their pre-war level and when the annual charge for the better type of road will again, with a given traffic, be equal to or less than that of maintaining a cheaper surface."

The above extract from a recent editorial of a technical publication sounds a timely note of warning that should command the serious consideration of our public officials. For the past few months, numerous deputations from different sections of Ontario have urged our Provincial Highway Department to build nothing but concrete on our provincial system. The folly of committing the province of Ontario to a road programme of $90,000,000 for a small percentage of our total highways must be apparent to any one who reflects on the situation.

The public at large will welcome the announcement made at the Good Roads Convention recently of the policy adopted by the Department of Public Highways for the provincial system. This "pay-as-you-go" policy is particularly appropriate at the present time when labor and material prices are unusually high. Many States in the Union are becoming much alarmed at their rapidly increasing road bond indebtedness for expensive pavements that too frequently must be resurfaced with a suitable wearing surface long before their bonds have matured. The tendency is to build more cautiously by establishing well consolidated macadam bases, thoroughly drained, and surfacing them with bituminous tops. Our engineers who served in France appreciate the traffic carrying capacity of well maintained roads.

A recent article on "Asphalt Constructed on a Macadam Base" states that 21 miles of the Warnersville-Palmyra road, one of the main thoroughfares of Pennsylvania were recently surfaced with a 2½ in. asphalt top at 91 cents per square yard. Another example of economical construction is that of a 2½ in. sheet asphalt surface constructed in Burlington County, New Jersey, in 1917 on a gravel base at a cost of $1.32 per square yard, including the cost of gravel shoulders. Absolutely no maintenance charges on these roads have been incurred to date.

Irving T. Patterson, Chief Engineer, State Board of Public Roads, Rhode Island, in writing on Asphalt Macadam Roads, states that "in no case has the main-

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Canada's Engineers—J. G. Sullivan

Mr. John G. Sullivan, consulting engineer of the Canadian Pacific Railway Company, and formerly chief engineer of that company, can date his railroad experience back to 1888, in which year he graduated from Cornell University with the degree of C. E. He is an American by birth, his home being Bushnell's Basin, Monroe County, N. Y., where he was born in 1863. Since his graduation from college, he has followed railroad engineering in all its phases, chiefly in the western part of the United States and Canada. His first job was as rodman on the Great Northern Railway in 1888. In the following year he took a position as instrument man and assistant engineer on the Spokane Falls & Northern Railway, one year later rejoining the Great Northern Railway as assistant engineer. After three years in that capacity he became assistant engineer of the Alberta Railway & Coal Company. Mr. Sullivan then had a varied experience as locating engineer with the Butte, Anaconda & Pacific Railway, 1894; principal engineer, Kaslo & Slocan Railway, 1895; reconnaissance engineer, Columbia & Western Railway, 1896-98; and principal assistant engineer, Columbia & Western Railway, 1898-1900.

In 1900 Mr. Sullivan joined the Canadian Pacific Railway Company as divisional engineer of construction, retaining this position until August of 1905. From September, 1905, to January, 1907, he was assistant chief engineer of the Panama Canal. He then returned to the C. P. R. as manager of construction, Eastern Lines, and in September, 1908, became assistant chief engineer at Montreal. In February, 1911, he was promoted to assistant chief engineer, Western Lines, becoming chief engineer, Western Lines, in October of the same year. In 1915 he was appointed chief engineer of the system, remaining in this capacity till 1918, when he became consulting engineer of the company.

Mr. Sullivan has been very active in the interests of the American Railway Engineering Association, of which he was president in 1918. Other offices which he has held in this organization have been, chairman of Committee on Economics of Railway Location, from 1914 to 1917, and vice-president in 1916 and 1917. He is also chairman of the Manitoba Drainage Commission and is a member of the American Society of Civil Engineers and the Engineering Institute of Canada.

Mr. J. G. Sullivan

tenance been over $100 per mile and the average cost of maintenance we estimate to be $50 per mile." Mentioning a two mile section built under unfavorable conditions late in 1916, Mr. Patterson states that "it is however, gratifying to note that the maintenance costs of this road (two miles long) in 1918 and 1919 were $55.03 and $37.33 respectively.

Rhode Island has constructed asphalt macadam on some of their heaviest travelled trunk lines such as the Post Road from Providence to Westerly, the road between Fall River and New Port, the Putnam Pike, the Hartford Pike and the New London turnpike. Mr. Patterson states that the Post Road between Providence and East Greenwich carries an average daily traffic of approximately 3500 vehicles of which 300 are auto trucks.

These asphalt macadam roads were built at a cost in 1915 of $0.78 to $1.10 per square yard including foundation and in 1916, at $0.62 to $1.42 per square yard.

The foregoing are typical examples of asphalt construction that are truly economical, being low in first cost and very low in maintenance, therefore their actual cost to the ratepayers is extremely low.

When these figures are compared with those of a rigid pavement costing from $30,000 to $50,000 per mile and whose annual maintenance charges are certainly no less, the economy of asphalt wearing surfaces on macadam bases is apparent.

Yours truly,
Toronto, Ont. K. D. McDonald (B.A.Sc.)

Major Cape Appointed to Montreal Charter Commission

Major E. G. M. Cape, the well-known contractor, has been nominated by the Montreal Administrative Commission as the English speaking member of the Montreal Charter Commission, authorized by the Quebec Government to report on the civic government of Montreal. The Administrative Commissioners had power to nominate two members of the Charter Commission.

$400,000 Bridge Project in Quebec

The Quebec Government is willing to pay half the cost of the construction of two bridges between St. Anne de Bellevue and Ile Perrot, and between Vaudreuil and Ile Perrot, provided the Federal Government will pay the other half. The project is estimated to cost $400,000. The municipalities interested will have to contribute $100,000, which will be repaid by a system of toll gates.

Celebrates Jubilee as Land Surveyor

Mr. Brian Douglas McConnell, C.E., Q.L.S., Montreal, was the recipient of a gold headed walking stick on the occasion of his golden jubilee as a land surveyor. The presentation was made by Mr. Thomas Kirk, on behalf of Mr. McConnell's fellow land surveyors. The Hon. J. P. Casgrain, president of the Corporation of Quebec Land Surveyors, presided.

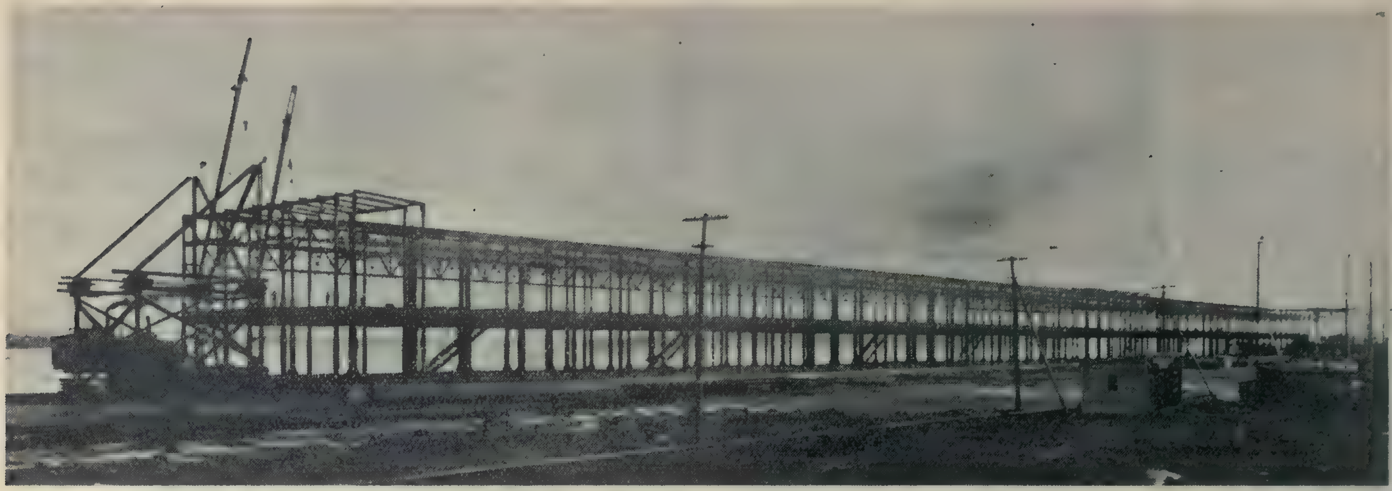

Fig. 1—Transit sheds Nos. 21 and 22, Halifax Ocean Terminals; steel work completed

Steel Design and Erection on Transit Sheds at Halifax Ocean Terminals

Sheds No. 21 and 22, 1210 ft. Long and 87 ft. Wide, with 3600 tons of Steel, Erected in Six Weeks with Twin Derrick Traveller

By J. Robertson, B. Sc., A.M.E.I.C.*

THE Dominion government's extensive harbor development at Halifax, N. S., has been further advanced by the erection of the steelwork for the permanent transit sheds No. 21 and No. 22. Fig. 2 gives a general idea of the location of these sheds in the finished scheme, which, when finally completed, will provide Halifax with splendid facilities for accommodating the largest ocean going vessels. It was originally intended to erect sheds Nos. 24 and 25 first, and part of the steelwork was fabricated with this idea in view. However, war conditions delayed the delivery of certain structural shapes from the rolling mills in the United States and the explosion rendered the necessity of having the accommodation so imperative, that they were built of timber instead. The sheds being all of similar design it was an easy matter to transfer this steel to Nos. 21 and 22 and it was, therefore, all used as originally fabricated.

The two sheds have a total length of 1210 feet in 22 ft. longitudinal panels and consist of four main rows of columns forming three transverse bays. The centre bay is 33 feet wide and the two side ones 27 feet, giving a total width of 87 feet from centre to centre of columns. Halfway down the building five panels are utilized to give a central office building providing accommodation for the steamship companies, custom officers, etc.

Fig. 3 shows a typical cross section of both sheds, the overall height being about 52 feet. All heavy cargo will be handled on the ground floor, while the main floor will be devoted to the use of passengers and the sorting-out of their baggage. The latest equipment for handling grain will be installed at some future date, consisting of an elevator, conveyors, travelling grain tower and spouts. This made it necessary to lower the roof trusses in the bay next to the harbour about 9 feet and to make them strong enough to carry the conveyor belts and machinery.

Design of Steelwork

In designing the steelwork the following loads and unit stresses were used:—

Rocf:—Dead and live 50 lbs./sq. ft.
Purlins 5 lbs./sq. ft.
—
55 lbs./sq. ft. on purlins.
Trusses 5 lbs./sq. ft.
—
60 lbs./sq. ft. on trusses.
Horizontal wind on all vertical surfaces 30 lbs./sq. ft.

Siding:—Corrugated sheating plastered with concrete 2 in. thick, giving a total weight of 30 lbs./sq. ft.

Doors:—10 lbs./sq. ft.

Floor Loads:—Grain Gallery D + L = 100
Steel = 10
—
110 lbs. sq. ft.

Main Floor:—Concrete 100 lbs./sq. ft.
Beams 10 lbs./sq. ft.
Live load 600 lbs./sq. ft.
—
710 lbs./sq. ft. on beams.
Girders 15
—
725 lbs./sq. ft. on girders

Trolley Beams:—Dead 5000
Live 6000
Impact 3000
—
14,000 lbs. concentrated moving load.

Unit Stresses:—Tension 16,000 lbs./sq. in.
Compression 16,000—70 l/r lbs./sq. in.

When considering wind stresses alone or in combination with dead and live load stresses, 25 per cent. was added to the allowable unit stresses, provided that the section found was not less than that required if wind were neglected.

Bearing on foundations:—500 lbs./sq. in.

The unusually high live load of 600 lbs./sq. ft., which had to be allowed for on the main floor, made the steelwork of a very heavy nature. Bethlehem shapes were used for all the columns, the bottom sections ranging from 14 in. at 91 lbs. to 14 in. at 178½ lbs. with a maximum load of 609,000 lbs., while the top sections were 10 in. at 49 lbs. and 59½ lbs. with a maximum load of 137,000 lbs. A typical girder in the main floor had the following cross section: one 60 in. x ⅜ in. web, two 6 in. x 6 in. x 11/16 in. flange angles, one 14 in. x ½ in. cover plate and one 14 in. x 7/16 in. cover plate with floor stringers of 27 in., 90 lb. I's framing into it.

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*Erection Department, Dominion Bridge Company.

Two Derrick Erection Traveller

The heaviest piece to be erected weighed 9 tons and as the peak of the building was about 60 feet from the ground level, an erection traveller was designed to meet those conditions. This can be seen in Fig. 4. It consists of two standard 12-ton stiff-leg derricks mounted on a framework of timber. This framework was 37 feet wide by 33 feet long and 20 feet high, 12 in. x 12 in. timbers being used for the sills and uprights and 10 in. x 3 in. planking for the bracing. Two 30 h.p. double drum hoisting engines were located on a floor at the rear and served the double purpose of supplying power and acting as a counterweight. A small office was also built on timbers cantilevered out, for the purpose of keeping erection plans, small tools, etc., always handy at the point of erection. The whole was mounted on four double traveller trucks and travelled backwards on two rails laid 37 feet centre to centre. The booms of the derricks were 14 in. x 14 in. x 60 ft. long with two channels bolted on the end to act as an outrigger for a single whip, run off the nigger-head. This saved a great deal of time in erecting all the small pieces and gave the derricks a larger radius as well.

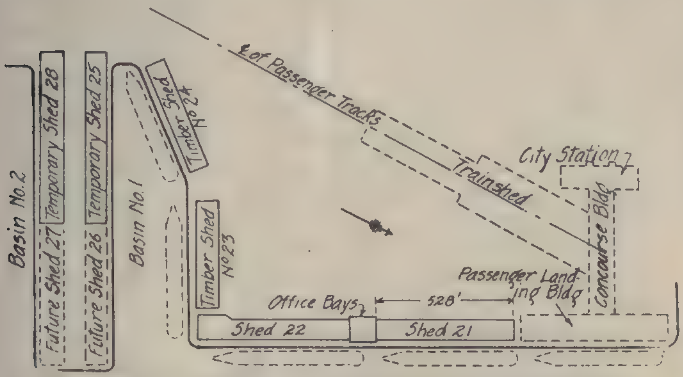

Fig. 2—General layout of transit sheds No. 21 and 22, Halifax Ocean Terminals

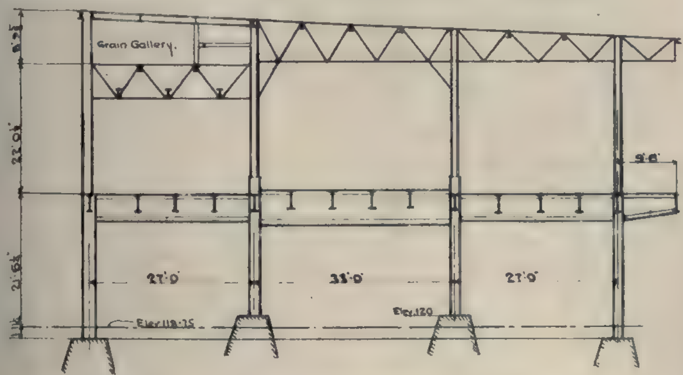

Fig. 3—Section of shed to show nature of framing

Early in the summer the Canadian National Railway installed a standard gauge track along one side of the building for its entire length, and this was used as a service track. All the steel was delivered by rail and a 30 ton "Industrial" crane unloaded it from the cars and distributed it systematically into piles of similar pieces. This proved to be a great benefit and a large saving was realized both in time and money, by not having to search all over the site for a certain piece when required.

100 Tons Erected per Day

Preliminary work was commenced at the site in July 1919 but the actual erection did not commence until September 3rd. Before starting erection, all the column foundations were carefully checked for level and line and brought to exact grade with cement grout put on by expert cement finishers. This ensured the columns having an even bearing on the concrete, saved the large amount of plumbing usually necessary to bring the steel to line, and enabled all field connections to come properly and easily together. The main steelwork was erected by November 3rd, with an average gang of fifty men per day on the job. Owing to the very exposed nature of the site and the lateness in the year, eighteen days were lost in this time on account of high winds and rain. This makes the actual erecting time about six weeks, and gives an average of 100 tons erected per working day. Trouble was also experienced by the sand drifting into the journals and bearings of all the machinery causing undue wear. The field riveting was started on September 22 and is now completed, air being supplied by a portable 8 in. x 12 in. steam driven straight line compressor. The weather has delayed the field painting, but it will be started as soon as possible after conditions will permit. Fig. 1 shows the two sheds completed and gives a very good idea of the magnitude of the work. There were approximately 126,000 field rivets driven and it took 141 railway cars to convey the 3600 tons of steel work to the site.

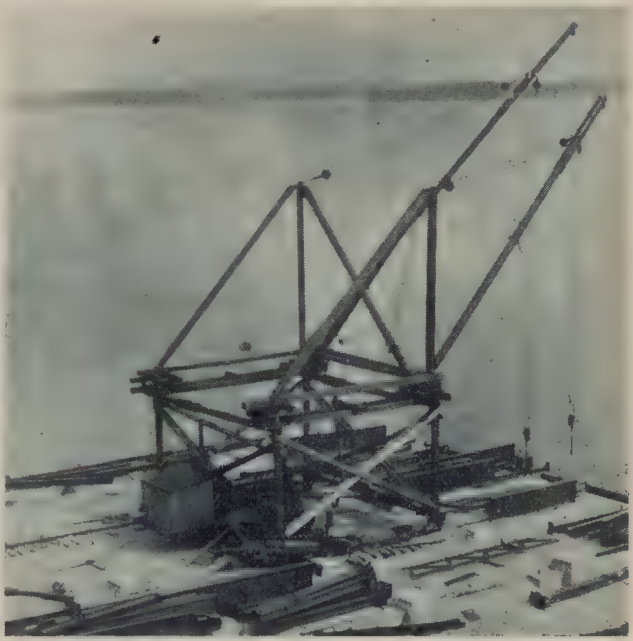

Fig. 4—Erection traveller comprised two 12-ton stiff-leg derricks on timber framework

The general layout of the sheds was arranged in the government offices at Moncton, N. B., under the charge of Mr. W. A. Duff, Assistant Chief Engineer. The steelwork was designed, fabricated and erected by the Dominion Bridge Company, Lachine, Quebec. Mr. McGregor was the government's superintending engineer in Halifax and the writer represented the Bridge Company.

Recent Advances in the Science of Ventilation From the Industrial Standpoint

Health of Workers Has Much to do With the Amount and Quality of Their Work—Improved Systems of Ventilation Benefit Industries—Application of the Newer Knowledge

By Geo. G. Nasmith, C.M.G., Ph.D., D.Sc., D.P.H.*

THE great national stocktaking which has followed in the wake of the war has emphasized certain facts very strongly. One of the most outstanding is that, whereas a few years ago capital was probably the most sacred thing in the world, this is no longer so; on the contrary, all that directly affects human life and happiness is now, in Anglo-Saxon countries at least, the thing of supreme moment. Most employers of labor, as a result of the war and its experiences, whether they wished to or not, have been forced to adopt a new set of working principles in regard to the health and welfare of the workers. As a natural consequence of this new point of view, held formerly only by certain people interested in questions of public health and public welfare, we are now hearing and reading much about reconstruction, of labor and capital, of the minimum wage, of shorter working hours, of profit-sharing and many other things which have to do with the problem of keeping the worker satisfied and giving him a fair share of the comforts to which he is entitled.

With the belief current among business men at the moment that production must be increased to the limit of our capacity, there is associated the principle that the worker himself must not be further exploited. With this end in view, efficiency experts have been employed not only, or even chiefly, for the purpose of increasing production but to endeavor to save the worker all unnecessary and useless labor. It is, of course, true that in most cases where the strength and energy of the worker is improved, the quality and quantity of his output will also increase.

Pays to Look After Health of Workers

Coincident with the changes which are steadily taking place in regard to labor and capital, great improvements have come in the conditions of environment under which labor is carried on. Through the efforts of public health officials and sanitarians during the past twenty years there has been a remarkable advance in factory hygiene and other matters of environment which tend to improve the health and efficiency of the workers. Numberless employers have come to recognize the fact that it pays to engage doctors and nurses to look after their employees and that it is good business to protect the workers from accident, dust, gases and other agencies which lower their physical efficiency.

In Toronto, before the war, there were five firms which employed welfare nurses to look after their employees. In the year after the war there were in the same city 28 firms employing qualified nurses. At the University of Toronto at the present time there are a number of graduate nurses taking the post graduate course in social service work with the object of fitting themselves for the field of industrial nursing. The Department of Health in the City of Toronto employs about one hundred nurses in welfare work and these doubtless relieve the smaller industries of much of their responsibility. All of which is evidence that even where the municipality takes the responsibility of looking after the general welfare of the community there is plenty of room for the extension of welfare work in private industry, and, also is an indication that from the business standpoint such welfare work is worth while.

Even where labor is unskilled it has proved a good investment to improve the working conditions, for then workers, as a result of improved surroundings, will remain longer on the job and there is a greatly lessened turnover of labor, which, in one striking instance in Ontario, amounted to 60 per cent. in three months.

The Effect of Environment on Health

The human body is an extremely complicated machine whose efficiency depends upon the mutual cooperation of many factors. When all of the body functions are operating in harmony we have the conditions which may be summed up in the term health. The health of the body is shown among other things by its ability to perform work and to resist disease. The effect of outdoor life, of regular exercise, of regulated hours, of carefully controlled environment and medical supervision was wonderfully well shown in the civilian armies during the war. In the army, men, formerly of sedentary occupations, rapidly became strong in body, perceptibly broadened out and developed a most marked resistance to disease. Statistics show that there was actually less disease in the British army in the field than there was among the civilian population at home, in spite of the fact that the soldiers were continually subjected to all sorts of hardships and exposure. One could actually see the improvement taking place in the amateur soldier of a new battalion in the course of a few weeks; his brightened eye, his heightened color and his springy walk, all indicated that his muscular, nervous and vascular system were in fine tonic condition. There is no doubt that fresh air is nature's tonic and common experience proves that fresh air gives us a general feeling of well being.

In civilian life the conditions of environment of the average individual are quite different to those of the soldier. He is protected from sudden changes of temperature and undue exposure; his supply of fresh moving air is limited, his exercise is curtailed and he loses tone; as a consequence he is unable to react to sudden changes of temperature, his powers of resistance are reduced and he becomes more subject to attacks of disease. During the war it was clearly shown that in industries where the highest efficiency was desired, men and women could not be forced to work overtime without the price being paid in a reduced output of work and in an increased amount of sickness. It was also discovered that a weekly holiday was essential and that a shorter working day frequently resulted in an increase in the amount of work turned out.

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Environment in Industry

The purpose of industrial physiology is to determine the conditions under which the worker can perform his work most efficiently while maintaining his health, and furthermore establish in the factory and workshop the conditions which tend to produce the maximum output of work without impairing the maximum power of the worker. Much has been learned about the first of these problems, and when workers and employers realize that it will be to the advantage of both to organize industrial work on an intelligent basis the second will come about. Research committees in Great Britain and the United States have been carefully studying the relations of the hours of labor and other conditions of employment to the development of fatigue, giving due consideration both to industrial efficiency and to the preservation of the health of the workers.

In 1914 the Department of Health of Toronto entered upon a campaign to improve the sanitary and hygienic conditions in factories. It was then found that in many industries there was little or no protection against poisonous fumes and dusts, but in a very short time, hoods, ducts and exhaust fans for the purpose of carrying off these materials and protecting the operators were established in practically every place where such were needed, while existing sanitary conveniences were greatly improved. It was noteworthy that there was little opposition to the demands of the Health Department at the time but the willingness to co-operate has latterly become even more pronounced. The war has brought about a much more sympathetic attitude on the part of the employer to demands for improving the working conditions of the employees.

In the industrial plants of Toronto, which are much like those in any other large city, there are few modern ventilating systems. In general the system of heating is steam radiation and the air supply comes through the windows. In large factories window ventilation is very difficult and not at all satisfactory from the sanitary standpoint; even in smaller plants, though fair results may sometimes be obtained with intelligent management, the method is almost sure to entail drafts with a certain amount of risk to a number of employees. An ideal system of washed, humidified and tempered air forced into and drawn from the workrooms by fans is not, to the writer's knowledge, to be found in a Toronto factory, though partial systems are to be found in some schools and office buildings.

The Newer Knowledge of Ventilation

It is generally recognized among sanitarians and hygienists that a small improvement in sanitary or hygienic conditions, which will improve the health and efficiency of all the members of the community, by say five per cent., is of infinitely greater value than one which will improve only a small percentage of the community by say 25%. In a city for example, an improvement which makes the water and milk supply safe, favorably affects every single member of that municipality and counts more in promoting the general health and efficiency of the whole community than the individual work of hundreds of doctors and nurses in directly curing cases of disease once they have been contracted. In the field of public health an ounce of prevention is worth many pounds of cure.

For this reason any improvement in a system of ventilation will have far reaching results. Everybody lives, moves and has his being in an atmosphere which he constantly inhales and exhales; which literally surrounds him like a garment; which is the medium that carries germs of disease to him; and which, through its temperature and moisture, constantly affects his skin and through the skin all the vital processes of his body.

It is of great theoretical interest to know that some of the most remarkable developments in hygiene during the past few years have been in the problem of ventilation and it is of great practical importance to realize that this new knowledge of ventilation can be applied to the great benefit of the community at large.

In 1905 Paul showed very clearly that all the ill effects of bad air were not due to chemical but to physical characteristics. He had subjects live in an air tight cabinet and allowed them to rebreathe the air until they began to show depression, headache, dizziness or even a tendency to nausea. When allowed to breath fresh outside air through a tube no relief whatever was experienced, neither did the bad air from the inside of the cabinet produce any symptons in a person outside of the cabinet breathing the air through a tube.

Good Effects of Stirring up Stagnate Air

When the air in the cabinet was dried, or cooled, or put in motion by means of a fan all of the symptons of discomfort and illness immediately disappeared without any chemical alteration being made in the air. The result of stirring up the air in the cabinet, cooling it or removing the excess moisture by drying simply enabled the human body to throw off its heat more rapidly. In other words the symptons arising in vitiated atmospheres are due to heat stagnation in the body, and the moisture of the atmosphere, its temperature and its stillness are responsible for the effects produced.

These findings of Paul have since been shown over and over again by numerous scientists to be correct. In recent years the New York Commission on Ventilation, which experimented upon hundreds of human subjects over a period of years, has further confirmed these findings and thrown a great deal of additional light on the subject. The Commission proved conclusively that the bad effects of poor ventilation are due almost solely to excessive humidity, to increased temperature and to stagnation of the vitiated air.

The New York Commission kept men in airtight rooms day after day rebreathing air that contained all the accumulated products of the breath. Yet they did as much mental and physical work and felt just as happy as when fresh air was constantly supplied to them, as long as the temperature of the air was kept low. Very careful tests were made by skilled scientists to determine whether there were any ill effects upon the heart, circulation or general efficiency of the body but none could be detected. The Commission found that the whole secret lay in the fact that the air around the body was stagnant and that as long as this air was continually removed or its temperature lowered there were no harmful effects, even though its carbon dioxide content was increased to many times its normal amount and its oxygen content greatly reduced.

Results of Increase in Body Temperature

It was found that slight rises in the body temperature may be produced by a higher temperature of the surrounding atmosphere and that these rises produce marked physiological effects, such as an increase in the heart beat. A considerable rise in the atmospheric temperature may also quicken the respiration. Passing from a hot to a cold room results in an increased secretion of the nasal mucous membrane, and this condition seems to be favorable to invasion of that protective layer by micro-organisms and, consequently, to infection.

The actual inability to do as much physical work on a very hot day has been proved by confining animals in very hot cages for several hours and then showing by accurate scientific tests that their muscles were incapable of doing as much work as they had been before being subjected to the heat. It is, therefore, natural that on a hot humid day we should reduce our muscular exertions to the minimum, in order that we may not have so much heat to get rid of. The power to perform physical or mental work at moderately higher temperatures is not at all impaired but the inclination to do physical or mental work is diminished—a most important point in industry.

Without going into the actual details of experiments and the results obtained by numerous investigators in the problems of ventilation, it has been found that in general, moderately cool and moderately dry air in motion is the most beneficial to the human body. A temperature of from 65 to 68 degrees Fahrenheit with a relative humidity of not more than 50% is about the best where great physical labor does not occur. Furthermore, the stimulating effect of fresh air on the human body depends not on its chemical composition but on its physical characters, namely, low temperature, low humidity and motion.

The Value of Improved Systems of Ventilation in Industry

In workshops it has been found that a change of temperature of a few degrees is stimulating to the worker and tends to increase the output, whereas a constant temperature is depressing to the individual. From the standpoint of the employer and employee these facts are of the greatest value. Proper changes in the system of ventilation in many industries based upon the newer knowledge will bring about beneficial results in the health and efficiency of the workers and in their output of work. The ideal system of ventilation should accomplish several things. It should first of all maintain the air at a proper temperature and humidity; it should keep the air in gentle motion; it should remove odors, bacteria, dust and other contaminating substances, such as gases, and should provide a sufficient quantity of fresh air to remove all products of respiration.

There can be no sound hygienic objection to the warmed air of a building being recirculated, provided always that it is partly diluted with outside air and washed free from bacteria, dust and odors by passing through water screens. This washing acts exactly as a rain shower in nature, thoroughly cleansing the air of all impurities. Such air may be cooled, warmed and humidified at the same time to the exact degree desired. As an example of the saving effected, it is said that in the gymnasium of the International Y. M. C. A. at Springfield, where this process is in operation, a saving of over 40% of coal from recirculating the air is effected.

Intelligent Control of Ventilation

The intelligent use of windows in flushing out the building during the rest periods, which are becoming common in modern factories, have a beneficial and stimulating effect on the employees and many other modifications will probably develop as the skilled ventilating engineer, watching results, develops his plan of operating the system. Any scheme of ventilation, whether artificial or natural, will fail if it is not operated intelligently, and the intelligence in this case presupposes a knowledge of the ends to be attained and the reasons therefore. When it is realized that in one experiment as much as 15% less work was done at 75 degrees Fahr. than at 68 degrees Fahr., the value of careful and intelligent control of ventilation may well be appreciated. Overheated rooms are not only uncomfortable but produce well marked effects upon the heat regulating and circulating systems of the body and materially reduce the inclination of occupants to do physical work.

There can be no question as to the value of these modern developments in ventilation in improving the health and stimulating the energy of the worker. With a general improvement in the physical well-being of the individual there is little doubt that his daily output of work will be increased. In overhead, stuffy rooms the worker will unconsciously do less work; from the physiological standpoint it is perfectly natural that he should.

Some of the workshops and factories in this country are a disgrace to the owners and to the community. Public health officials and factory inspectors have done a great deal to gradually force unwilling employers to instal the minimum sanitary requirements demanded in the interests of public health and safety. But beyond these minimum requirements many employers have no intention of going. They will not realize that a dollar invested in improved hygienic conditions for their employees will be almost sure to yield a return many times as great, both in the quality and quantity of the work turned out, in reduced sickness and in lessened liability to accident.

When Fresh Air Is Good

From what has been said above it must not be inferred that fresh air is of no use, that the practice of underheating or suddenly chilling hot workrooms is to be recommended, or that recirculating unwashed air is a thing to be desired. This discussion has no such object and the writer would be the first to condemn such practices. From the standpoint of the individual and the public health everyone should get as much fresh air as possible.

Our viewpoint of what constitutes fresh air, however, has changed materially and our practice will naturally change also. The important thing to appreciate is, first, that fresh air is valuable because it is cool or is in motion; and second, that fresh air is not valuable because it has a slightly larger amount of oxygen or a slightly lessened amount of carbon dioxide than indoor air. These are physiological facts which have been proved beyond all question of doubt. On the other hand, one must appreciate the physiological effect of so-called bad air on people coming into it from fresh air.

The humidity is an extremely important factor. It is a matter of common experience that we feel disinclined to work on moist, hot sticky days when the humidity of the air is high. There is a definite physiological reason for this. The temperature of our bodies is controlled through the amount of heat lost through the skin by the regulated evaporation of visible or invisible perspiration. At a high temperature, as the humidity of the air surrounding the body increases, the moisture constantly given off from the surface of the skin is less easily evaporated and therefore, less heat is lost from the body. If the temperature of the air is high when the humidity is high, we experience great discomfort because our bodies are unable to get rid of their superfluous heat by these methods. On the other hand, the air may be saturated with moisture, as it often is over the sea or in insular climates, and yet be very invigorating because it is cool and carries away through conduction any surplus heat that the body needs to be rid of.

On humid days the humidity in places where large numbers of workers are congregated increases and the normal conditions of discomfort due to excessive humidity become aggravated. On the other hand, a temperature over the desert may be even as high as 115 to 120 degrees Fahrenheit and yet be quite bearable because the relative humidity is so low that the dry air rapidly carries away the moisture from the surface of the skin and thereby reduces the temperature of the body. Very dry air, such as we get in practically all of our buildings during a Canadian winter, is also very objectionable, drying up the mucous membrane of the eyes, nose and throat and creating a most uncomfortable feeling which is very obnoxious to people accustomed to a moister climate. High temperature combined with high humidity produces not only discomfort but definite symptons of physiological derangement, such as a rise in body temperature and pulse rate and a fall in blood pressure, doubtless due to manifestations of the body's effort to reach a state of heat equilibrium with the outside environment.

Remodelling Our Systems of Ventilation

With an understanding of the principles here outlined it may be seen that it will be quite possible and feasible from the economic standpoint to materially modify our systems of ventilation with great benefit to the health and energy of the worker and the output of the plant. From the commercial standpoint it would probably pay well to instal in almost every new factory the most modern ventilating system and employ an up-to-date engineer at the single task of watching the ventilation with the efficiency of the worker in mind; the output of the factory would take care of itself. Such an engineer as the writer foresees him will carefully control the temperature, the humidity and the movement of the air.

Summary

Accurate and elaborate physiological studies on hundreds of human beings have shown that air temperature and air humidity have profound effects on the human organisms. When air conditions are unfavorable the health and efficiency of the subject is likely to be seriously impaired. But since we now possess accurate knowledge of how temperature and humidity affects the human body, and particularly since there are practical mechanical methods of controlling and modifying these factors at will, there is no reason why we cannot live indoors under atmospheric conditions which at least approximate the ideal.

Taking these facts into consideration it would appear to be an excellent investment to provide only air that has been so tempered and conditioned that it will improve the health and increase the efficiency of the employee, whether in office, warehouse or factory.

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800 Miles of Road Grading and 100 Bridges on Manitoba's Program

Substantial Progress to be Made This Year Under Provisions of Good Roads Act—All Work by Contract

MANITOBA has always been very active in road construction. Great progress has been made in the improvement of highways in the past few years and this year will see a substantial increase in the mileage selected for grading and surfacing. As evidence of this, we might state that tenders for grading about 800 miles of roads will be called for in Manitoba within the next two months, according to information supplied by the Good Roads Department of that province. This work will be let in contracts of from two to seventy-five miles. The work will be done under "The Good Roads Act," which has been in successful operation in Manitoba for the past six years. Up to the present, about 1,200 miles of road have been graded and about 400 miles gravelled, under this Act.

In addition to the roadwork, it is expected that over 100 concrete bridges will be constructed. The bridge work will include a steel bridge 650 feet long over the Red River, a concrete arch 100 feet clear span over the La Salle River, several bridges of concrete over the Assiniboine River and a number of bridges of from 30 to 50 feet clear span. Up to date there have been built under "The Good Roads Act," 384 bridges of which 271 were of concrete.

It is expected that over 4,000 miles of grading will be done in Manitoba within the next four years, and a large percentage of this mileage is to be gravelled. Under "The Good Roads Act," all work is to be let by contract.

Production of Building Materials in Quebec

The production of building materials in the province of Quebec increased considerably during the year 1919, compared with 1918. Its total value for the year amounted to $7,974,084, compared with $5,340,987 for 1918, an increase of $2,633,097.

Gunite Houses Meet Structural Requirements

Dwellings of Plastered or Cement Gun Construction Can be Insulated Against Heat Conduction and are Strong and Fireproof

THE plastered or gunite concrete house is one having a reinforced concrete structural framework, either cast in place or shot with a cement gun and having comparatively thin exterior double walls of concrete formed by plastering or shooting concrete on expanded metal, or mesh reinforcement. This type may or may not have concrete floors and roof. If not of concrete, metal lumber makes the best substitute. Wood floor joists and wood stud partitions can be used when economy in first cost is demanded.

One of the greatest, if indeed not the greatest, objection to monolithic concrete construction is the bother and expense of forms. This is particularly true of dwelling house construction because of its endless variety, with complications of openings, angles, etc. There can be no question but that the ultimate to be desired in concrete house construction is a design in which every piece that is erected remains put and forms a permanent, integral, necessary part of the structure. For this reason the cement gun or plastered type of house is deserving of consideration. That this type seems to meet the essential requirements of house design is indicated in a report of the committee on Plastered or Concrete Gun Types of Concrete Houses submitted to the National Conference on Concrete House Construction held last month in Chicago. Some of the findings of this committee follow:

Insulation Against Heat Conduction

The first fundamental idea of this group of designs is the matter of insulation against heat conduction.

Insulation is a matter which vitally affects the comfort of a house, as well as the cost of heating it. Control of heat loss and ventilation is fundamental to success in the design of a heating plant, and such control cannot be obtained with exterior walls having poor insulating qualities. Insulation of exterior walls of houses is also required to prevent condensation of moisture on the interior surface of these walls, regardless of the type of construction. Masonry walled houses are always furred, lathed and plastered on the inside, thus producing an air space between the masonry wall and the interior of the house, which furnishes the required insulation to prevent a sufficient difference in temperature being established between the wall surface and the air within the house to cause condensation. Concrete houses, of whatever type, are no exception to this requirement for insulation, and the designers of this group make it possible to supply the requirements of insulation by including a dead air space in the wall proper. The plastered and gunite types have a concrete exterior wall about 2 inches thick, separate from the interior finish by a dead air space, as will appear by examining the various methods of constructing this type of house given herein.

Air Space Must be "Dead"

Any air space in a wall to be effective must be "dead," that is, have no connection with the outside of the building, and should be limited to such width and arrangement as to prevent convectional currents of air being set up within the dead air space itself. The outside wall of the plastered or gunite house is usually only from 1½ to 2 inches thick, but this wall is reinforced in all directions by expanded metal or mesh reinforcement which is completely imbedded in the wall. The wall is moreover supported on all four sides by the reinforced concrete framework so that it is required to act merely as a "curtain" wall. Good workmanship will insure a very dense wall 1½ or 2 inches thick which is not only impervious to moisture under the most severe weather conditions, but also prevents any appreciable transfer of air between the dead air space and the exterior. While the wall itself possesses some insulating value, it is to be remembered that the entrapped air within the dead air space is depended on for insulation.

If a very high degree of insulation is desired, this type of construction allows the use of various insulating mediums, such as heavy waterproof building paper, corkboard, linofelt, Cabot's quilt, insulite or flaxlinum, etc., which can be applied in sheets directly to the inside surface of the outside wall.

Strength and Fireproofness

The second fundamental requirement, viz., strength, firesafeness and permanence, is fully met by this method of construction but an examination of building codes in various cities reveals the fact that the requirements of the construction of ordinary dwelling houses are based on familiar practice in the construction of masonry walls comprised of small units set in mortar, or on frame construction. The plastered or gunite type of house, as above defined, may truly be said to be a new type of construction to most building commissioners and inspectors. It is not to be expected, therefore, that present building codes provide directly for the use of such construction. However, this type does fulfill the fundamental requirements of strength and fire-resistive qualities. The structural framework is of reinforced concrete cast in place or shot into place with a cement gun. The sizes and reinforcing of the various structural parts are easily varied to meet all specified load conditions and are matters of simple engineering design. The exterior walls are, of course, thin as compared with those specified for ordinary masonry bearing walls, but it should be borne in mind that this is an entirely different type of construction. The exterior walls of the plastered or gunite type of house have a reinforced concrete frame which in conjunction with the reinforced thin slabs make strong and rigid bearing walls and have the elements of strength of the well known reinforced concrete floor. Lack of familiarity is, therefore, the only excuse for hesitation in allowing this type of dwelling house to be constructed within the fire limits of cities or in any other localities.

Walls Stand Fire Test

The results of such tests as are available on the fire-resistive ability of a concrete wall 2 inches thick, reinforced with mesh or expanded metal, indicate its ability to withstand the 2-hour fire test without serious injury. It will be recalled that the usual building code requirement for the thickness of concrete covering over reinforcing for flat surfaces, such as in floors, is from ¾ inch to 1½ inch, with an average of about 1 inch. This indicates at once that the exterior reinforced concrete wall, 2 inches thick, practically fulfills the usual building code requirement for fireproofing even in the large fireproof buildings.

For usual dwelling houses there is not sufficient combustible material to produce a fire of sufficient intensity and duration to affect in any serious way the reinforced concrete framework of this type of building. A favorable insurance rate is, therefore, justified for this type of construction.

Wall Acts Like Wire Glass

Another point that occurs to the committee in examining the group of designs is the fact that there has been introduced here an entirely new element of safety, elsewhere non-existent. It will be noted that in all these designs there is a form of wall construction consisting of relatively thin walls with relatively a very high degree of steel reinforcement, all thoroughly knit together into a strong unit. The effect is the same as that of wire glass. It may be cracked and broken, but it will not go to pieces. Not only should it be in a high degree cyclone and earthquake-proof, but it should be like wire glass, flame resisting.

Cement Gun Type Meets Structural Requirements

The conclusions which the committee reaches after examining the designs available in this group are as follows:

(1) All structural requirements are fully met in the plastered or gunite type of house herein defined.

(2) The framework and walls of this type are of fireproof material and are sufficient to withstand without serious injury any conceivable dwelling house fire.

(3) It follows from conclusions (1) and (2) that building codes should allow this type of construction within the fire limit of cities, and that insurance rates should credit in full this type as fireproof construction in all portions where concrete is used.

(4) The insulating qualities of the double wall produced by this type (or method) is sufficient to prevent condensation of moisture on the interior of exterior walls and insulating mediums can easily be applied to obtain any desired degree of insulation.

(5) Concrete floors produce a thoroughly fireproof and sanitary structure. Concrete floors should preferably have embedded nailing strips or be covered with a layer of nail-coat to which a wood floor may be nailed or be covered by rugs, carpets, or special, easily removed floor coverings.

Flexibility of Design

(6) Plastered or gunite concrete houses lend themselves to flexibility of design so that the architect is not hampered by any predetermined unit in working out the design of his building. Furthermore, he can have different texture finishes for the exterior walls and trim the building with wood porches, cornices and the like as is customary in the standard wood frame covered with stucco, while at the same time securing the fireproof qualities in the exterior of the wall construction with a minimum expenditure of material, which is about one-third of what a monolithic 7 inch wall would be, thus conserving materials and operating to keep the cost of construction at a point that more houses can be built for a given amount of money than would be the case where heavy masonry walls are used.

(7) The particular type which a builder should select out of this group will depend on the availability and relative cost of materials, power, and of skilled artisans and common labor.

(8) All types are good in design, and will make superior houses, if the work is properly executed.

(9) A concerted effort should be made by the parties in this group to get tests made by the Underwriters Laboratories, so as to get definite and favorable rulings on city building codes and insurance rates.

A New Development in the Cement Field

Incorporation of Chemical with Clinker Produces an Impermeable Cement of High Strength

REFERENCE was made in the Contract Record of January 14, page 34, to a new development in cement. It was there stated that a new form of cement was being produced by the incorporation of a chemical with the clinker before grinding, the product showing very promising results in regard to strength and waterproofing qualities. This particular variety of cement is new as far as this continent is concerned, but has been in use in England, to a limited extent, for some years. Its manufacture has been developed in Canada and at the present time, we understand, some of this product is available. This new type of cement is designated Super-Cement, the term that has been applied to it in England.

About nine years ago Mr. J. F. Goddard, an English engineer, discovered that a compound of certain chemicals, when incorporated into portland cement clinker, during its manufacture, gave to the cement very useful and desirable properties. Since that discovery Mr. Goddard has continued his investigations with a view to perfecting the process and bringing it into actual practical use, free from all troublesome features. He had the assistance of well-known chemists and practical cement manufacturers in England, with the result that the new cement was produced commercially. This super-cement has been in successful use for about eight years and has been produced in commercial quantities for five years, although government war restrictions have somewhat retarded the extension of its employment.

Increased Hydration

Super-cement is made from any ordinary portland cement clinker, which is ground with a chemical ingredient that changes the physical properties of the final cement. The chief difference between the two cements is that in super-cement, particles combine more thoroughly with the mixing water. The chemical action which occurs when water is mixed with the cement is assisted to a considerable degree, practically all of the cement being hydrated and performing the functions of a true cement material. This property of increased hydration assures dense, strong, and water proof concrete, with the remarkable ability of adhering or clinging to particles of sand and stone, binding them together into a very dense and strong material.

Actual tests have proved that super-cement is strong in tension and compression, very adhesive and very impermeable. An increase in tensile strength from 10 to 50 per cent. has been observed, and an even greater increase in compressive strength. Further, the percentage of increased strength with mortars has always been very pronounced and greater than the percentage increases with neat cement. This indicates the great sand carrying capacity of super-cement.

Impermeable Properties

Super-cement is said to be especially non-absorbent and impermeable. Mortar, composed of one part super-cement and three parts sand and moulded into hollowed cylinders with walls 7/8-in. thick, and suitably connected to pressure tanks, not only withstood a water pressure of 200 lbs. per square inch at the age of 17 days, but dried out and became hard and sound with not the slightest sign of moisture on the outside. Similar mortars have also successfully withstood gasoline under pressure of more than 120 lbs. per square inch, for over 13 weeks, with no leaks.

In a book called "Cements, Limes & Plasters," by Ernest A. Dancaster, B. Sc., consulting chemist, London, England, (published by Crosby, Lockwood & Son, London, 1916), the author remarks that super-cement was originally intended to be only a waterproof portland cement, the waterproofing qualities being obtained by adding a chemical to the clinker. It was found, however, that the treated cement not only made a waterproof mortar, but was also much stronger than ordinary portland cement, thus differing from the usual waterproofing materials which tend to weaken the cement with which they are used. The author, as the above mentioned work states, has carried out a number of tests with this material and has found the tensile strength after 90 days, of a 1:3 mix, to be about 50 per cent. greater than that of a similar mortar made from the same, but untreated, portland cement.

Quebec Reports Great Activity in Construction

An Analysis of the Building Situation in Province of Quebec Indicates Big Revival in All Lines

REPORTS from every part of the Province of Quebec indicate a pronounced revival in construction. The idea that costs would be lower has apparently disappeared, and the people who have money to invest in buildings have evidently come to the conclusion that the long expected era of comparative cheapness is a long way off. Further delay means additional expense, as labor costs are likely to advance.

The general condition of business warrants great constructional activity; in addition, there is a national shortage of houses and apartments. During the war the building programme was almost entirely neglected except for absolutely necessary work connected with the war; last year witnessed an all-round improvement, and the opening months of 1920 promise a considerable increase on this. The advance shown in the number of houses being built has no doubt been stimulated by the general rise in rents which is due to the shortage of accommodation and also to the higher cost of building.

"Not So Busy for Years"

The feature of the building world in Montreal is the number of small factories, etc., costing between $30,000 and $75,000, which are going up and which are contemplated. In the amusement field, plans are prepared, or will be drawn, for a picture house for the Famous Players' Corporation costing $500,000, and another one for the Allens, to cost about $500,000; while Loew's theatre is being remodelled at a cost of $150,000. School accommodation is urgently needed, and to meet this two Protestant schools, each costing $250,000, and two Roman Catholic schools to involve a total of $280,000, will be built. A synagogue is to be erected, at an expenditure of $250,000. The Provincial Government will spend a very large sum on new police courts, the land having been purchased, and Murphy's store contemplates an extension to cost $500,000. A very large number of flats, houses and apartments are being erected. In this connection, 50 houses and a school are to be erected in the model town of Mount Royal. The outlook in the city is very good, and architects and contractors have not been so busy for years, particularly as some have substantial jobs in other parts of Canada.

In the suburbs of Montreal, a lot of work is in progress or contemplated. Many houses are going up in Outremont, while plans have been prepared for a $250,000 school. In Verdun, a $100,000 school is being erected, and plans are being drawn for a new filtration plant in Lachine.

Revival in Industrial Construction

Probably the most hopeful aspect of the question is the large amount of work throughout the province, especially in the towns which are building up great industries, on account of the availability of cheap electric power. Take Three Rivers as an example. Here work of every description is proceeding at an extraordinary rate. The expansion of the pulp and paper and shipbuilding industries means much to Three Rivers. Houses are necessary to accommodate the workmen; new stores and schools are naturally wanted; and the era of prosperity which has come to the city has involved hundreds of thousands of dollars in building. An enormous pulp plant is being erected; other additions to existing pulp and paper plants are being carried out; a school to cost $200,000 has been authorized; and an extension to a cotton plant will mean the outlay of half a million dollars.

The most important work in the city of Quebec is at the Chateau Frontenac, where the excavations are being made for a two million dollar addition. Besides this, there is a $300,000 seminary, a $200,000 church, a $100,000 store, and many less costly works.

At Shawinigan, the progress made last year is being continued. The Belgo-Canadian Pulp and Paper Company propose large extensions to their mills, and other work is going ahead. At St. Hyacinthe a technical school and city hall is proposed, while a cotton mill, to cost $125,000, is going up. Not to be left behind, Sherbrooke is to have a textile mill, and in order to provide houses for the workmen $450,000 will be spent on a model village, under the Quebec Housing Act. Drummondville, too, is advancing; several new industries are to be located there, including a very large factory for manufacturing fibre for auto trucks.

There is exceptional activity in the Saguenay district, where Price Bros. are carrying out extensive plans for their pulp and paper industry. New mills are being built, and hydro-electric developments, including dams, constructed. A new town is to be founded at Saguenay, in order to provide homes for the additional workmen. This will be a real model town, laid out on scientific lines. At Gand'Mere, the Laurentide Company, Limited, will put in a new waterworks system and build 40 houses, and at Richmond, Bonaventure County, the erection of a sulphite pulp mill is contemplated.

From the above, which does not take in road work and other municipal improvements or minor buildings, it will be seen that the season has opened in a distinctly satisfactory way. We are looking forward to great things.

What are a City's Paving Problems?

1. An Honest, Efficient City Government;
2. Raising the Money Properly;
3. Spending it Properly

—By Chas. A. Mullen*—

A CITY'S paving problems. What are they? A wag once defined them as raising and spending money, more money, and still more money, principally for the personal benefit of the spenders, meaning the politicians, and the spendees, meaning their politico-contracting friends. Many true words are spoken in jest; for several exposures have proven that the politician spenders and the contracting spendees were both the agents of the same selfish and corrupt interests. In most North American cities, at least until recently, the situation could very well be summed up in the words of Mr. Wag.

Even in my own day most paving was laid primarily for the graft there was in it, and only secondarily as a roadway covering intended to resist wear and render community service. Thank our lucky stars municipal affairs on this continent are steadily improving, and we now quite frequently lay pavements primarily for use, both with municipal paving plants and through agreements with legitimate contractors working on a business basis.

If we, the citizens, have neglected our duties as such in the past, and have permitted our municipal affairs to be handled by a few professional politicians of the self-seeking class, what right have we now to object if we find that there was more politics put into our pavements than wear value for the money spent?

Why should we complain, for instance, if told that the money wasted in paving some of our streets, if saved and put at compound interest, would have created a fund that would keep a proper pavement repaired and renewed until doomsday. Yet, this is a fact; and now we face the unpleasant necessity of raising money to pay for new pavements on streets where we have not yet finished paying the bonds issued to build the old ones that have prematurely passed away.

You may ask me, as a member of the engineering profession, why city engineers, in the days gone by, permitted such paving work to be done; and I will reply that it was because they could not prevent it, and the citizens would not help them prevent it. In those days an engineer holding public office in the gift of politicians was supposed to draw his salary and mind his knitting; in other words, to speak only when he was spoken to. If he did not adhere strictly to professional matters in the narrow sense in which the term was then too often interpreted, and leave civic or political or business matters alone, he was apt to soon be seeking another job; and little the careless citizens of those days would have worried about whether he got it or not.

The First Problem

This will probably indicate that what I consider is the first part of a city's paving problem is: honest, efficient city government. Lacking this starting point, the solution of the remainder of the problems is practicaly hopeless; so if we want better streets and roads to drive and truck over during the next few years, it behooves us now to give very careful attention to the proper form of our city government.

The general development of good city government from bad has brought forth certain definite principles that are now embodied in a model city charter published by the National Municipal League, as a guide, to be altered for local application. This model city charter provides what may be briefly described as the commission-manager form of government with proportional representation.

The Second Problem is Raising Money

The second part of a city's paving problems is raising money. And right here I want to disabuse the mind of any man who thinks that good city government can be supported and well-paved streets constructed and maintained on a system of too low taxes supplemented by municipal hot air. The question should not be so much: "What is the tax rate?" as "How is the municipal dollar being spent?" If it is being economically and justly handled, we can possibly get more value from a Canadian dollar by municipalizing it through the tax roll than in any other way; certainly better value than they give us in the United States.

I do not see anything wrong in practice with the principals of issuing municipal bonds to pay for paving city streets, but the less it is necessary to resort to this practice the better. The matter should be governed by strictly business practice. Sometimes it is good tactics for a man to mortgage his house; sometimes not.

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*Paving Director, Milton-Hersey Co., Ltd., Montreal, before Kiwanis Club, Montreal.

The greatest difficulty is the temptation which municipal bonds offer to the crafty politician to spend money in this generation, have paved streets and both the political credit and graft that may be had by paving them, and at the same time maintain a low tax rate to show the people at election time so they will keep his party in office. Nearly all of this type of politician work to the motto: After us, the deluge.

Most of our cities have been through just this experience; but they do not wake up to the true condition of their municipal affairs until it is too late, and the city credit has been pledged to such an alarming extent that the evidence of it cannot longer be kept out of the tax rate.

Spending the Money

The third part of a city's paving problems is spending the money; not for the benefit of the spendee, but for the good of the city.

That is where we engineers and public works men are supposed to come in. Had we more to do with this spending in the past, and the politicians less, there would not now be a necessity for raising so much money for present needs or for defraying the funeral expenses and liquidating the unpaid debts of "dead horses" in the form of pavements which can no longer render an equivalent and must be replaced.

Pavement Construction

Pavement construction should begin with a careful engineering survey of a city's natural advantages from a paving point of view; not for each individual street at first, but with the entire city in mind. Then a general paving plan should be prepared. on which would be designated main thoroughfares for light. medium and heavy traffic, not for the purposes of making restrictions, but for taking care of the bulk of each type of traffic in the most natural way.

The types of paving to be used on different streets should be determined by engineers, not politicians; and the engineering department should always be ready and willing to give citizens definite reasons for its every action, to which the citizen is entitled.

The politicians have been making these selections more often than the engineers in past days, and as a result a paving map of most any one of our large cities, upon which the several types of paving are plotted in different colors, closely resembles great-grandmother's crazy work quilt.

The engineer should also decide when and where paving work is to be done, so that the presence of a few blocks of good paving on a street will not disclose the ownership of the abutting property as that of one politically in right, and the next few blocks of bad paving, the property owned by someone in wrong with the majority of the city council.

Pavement Maintenance

We construct a pavement once, but we maintain it forever. That is, we rather expect to maintain it that long. Therefore the maintenance problem is really a larger one than that of construction, and construction may truly be said to be merely incident to the beginning of maintenance and a part thereof. There is really no definite line of demarkation between the two.

Many items enter into this maintenance problem; not the least of which is the current rate of four to six per cent. on the municipal dollar. Whether that municipal dollar is a borrowed one, or the city's own dollar, makes no difference. It is worth so much rental per year either way.

This means that if a city can lay one pavement one dollar per square yard cheaper than another, and can maintain it for not more than the annual current interest rate above the amount for which it can maintain another pavement, these pavements are equally economical. This fact should cut out the laying of many of the higher priced pavements, such as wood block and vitrified brick, and limit the use of granite block to where it is most needed on very heavy traffic streets and steep grades which carry heavy weight traffic.

The real pavement is the artificial foundation for the wearing surface which is laid upon the properly graded, drained and rolled subgrade or natural foundation. Just as the real floor in your house is the floor-boards and not the rugs and carpets, so is the real pavement the artificial foundation and not the pavement wearing surface.

The carpets and rugs, and the pavement wearing surface, both wear out after a time, and must be renewed; but we expect something reasonably approximating permanence in our floorings and in our pavement foundations.

In paying for the real pavement, the artificial foundation, depreciation may be charged off very slowly, and bonds logically issued for a long term of years; but in paying for the pavement carpet or wearing surface, depreciation is much quicker and bonds issued for the purpose of paying for them should be short term securities.

Types of Foundation Surfaces

When it comes to artificial foundations, I am rather a strong advocate of portland cement concrete of standard construction, no fads and fancies allowed; but in some cases bituminous concrete may be used to great advantage.

In other cases, where the traffic is very destructive, a combination of both types has been suggested, a slab of hydraulic concrete on the bottom to supply the rigidity and a covering of bituminous concrete above that to take the shock, and then the pavement wearing surface to take the wear.

Old macadam, old granite or slag block, and other types of pavements are sometimes used as foundations for asphalt surfaces; and broken stone alone, properly placed and compressed, is frequently used as a foundation where the traffic is not too heavy for this type of work to stand up..

Pavement surfaces are divided into two broad classes: the small unit block or brick surface class, including granite block, slag block, wood block, vitrified brick, asphalt block, and others; and the bituminous sheet layer surface class, the bitumen being the cementing material, tar or asphalt, which holds grains of fine dust and sand and crushed stone or gravel together in the sheet layer that you find so pleasant to ride over on a city street.

Summing up, I repeat that these three are the most important factors in a city's paving problems:

1. An honest, efficient city government.
2. Raising the money properly.
3. Spending it well.

If these three points are kept in mind, and the second and third presupposed and are dependent upon the first, I think a city's paving problems are in a fair way to being satisfactorily solved.

Surveyors Uneasy About Status of Their Profession

Presidential Address before Ontario Land Surveyors Suggests a Broadening of Activities

By C. Fraser Aylesworth

MANY years ago, members of the Association of Ontario Land Surveyors were among the first to expound the doctrines of scientifically constructed roads, or what were then and are now known as "good roads." We all remember with what skepticism and uncertainty those doctrines of good roads were received by the great majority of our people. But what a difference we find today; instead of skepticism and uncertainty, there is an unanimous Canadian-wide demand that all the good roads that money can in any way be found to pay for, shall be constructed with as little delay as possible.

If all goes well, the province of Quebec alone will have expended thirty million dollars during the past and present year on the construction of highways. This is all eminently satisfactory, and demonstrates that while surveyors were then branded as visionaries, we are now proven as both practical and scientific.

Surveyors in Highway Engineering Field

In this good roads field, surveyors should quite naturally infer that there should be splendid opportunities for service by them. If we cannot round off our gradually diminishing surveying practice in some such field as highway engineering, then why is it? After bearing the burden of the propaganda that has finally resulted in this unprecedented demand for good roads, why are surveyors not called upon to construct them?. We are quite accustomed to the management of labor; from the earliest days the integrity of surveyors has been unquestioned; again, I submit, why are surveyors not in on the ground floor of this good roads program? A few are, but the great majority are not. In unity there is strength; united we win, divided we fall. I am of the opinion that we should broaden our organization by assisting towards the formation of a Canadian-wide organization, consisting of all members of all the provincial associations throughout the Dominion, for defensive purposes in order that the organization may possess an effective kick and punch.

Why should an Ontario land surveyor be permitted to collect only $5 per day as a witness while attending court on a survey case? Why should the Canadian Civil Service Commission be permitted to offer only $1,200 per annum as salary for a college-bred Dominion land surveyor? Why should politicians continually be permitted to secure positions of emolument that only surveyors should occupy by virtue of their technical experience, which would result in economical and efficient benefits to the public?

I shall merely generalize here, by not specially enumerating those positions, as surveyors are only too painfully aware of their traditionally handicapped position in this regard. The practice of surveying is more exhausting to the body than the practice of any other profession. It becomes very trying and hazardous to the older surveyors, and in the proverbial nutshell, it is a case of "Go it while you are young, for when you get old you can't."

Apparently at present there are no retiring positions dangling before the surveyor, to which his qualifications should entitle him to aspire, such as are continually in the foreground of the members of other professions.

Something Deficient

Do not all those conditions that I have pointed out clearly indicate that there is something deficient in our organization? And I am merely touching the fringe of this feature of our affairs.

It has been observed that members of such an association as ours will suddenly become very regular attenders of our annual meetings. They will take an enthusiastic and lively interest in all its affairs and proceedings, they will be nominated for office, they will be annually promoted until they reach the highest honor within the gift of our association,—the presidency. Then, presumably exhausted through past strenuous efforts, they suddenly extinguish their lights in so far as our association is concerned. Many past presidents, however, have not thus forsaken our association and have not thus deprived our annual meetings of their much needed ripe experience and fund of knowledge. Their regular attendance and lively interest and assistance is highly commendable and indispensable to the life of our association.

Organization needs no defence to-day. It is the all-inspiring spirit of the age, and Ontario land surveyors would surely be professional laggards, compared with members of other professions, if they permitted their organization to lag behind. Hence I trust that the young surveyor and the old surveyor will always recognize that it requires both to round off the profession, and that they will both work together with their shoulders to the wheel of progress, thereby promoting our individual and general interests and thus elevating the standard of the profession. It is more than ever the duty of past presidents to continue their active interest in our association.

As your president, I attended the last annual meeting of the Association of Dominion Land Surveyors, at Ottawa; while there I learned that there are distinct rumblings in the mulberry bushes, suggesting that steps be taken to broaden our organization. One educating and delightful part of their program was the carefully prepared lecture on the "Engineering Problems of the Great War," by General Sir Arthur Currie. This acquisition to their program was a complete "scoop" by our sister association.

We are pleased to learn that in the future the Department of Lands, Forests and Mines will place permanent iron posts at the corners in the new surveys. Let us not neglect to follow this up with a continuance of the educational campaign to have the governing township boundaries, in the older settled portions of Ontario, resurveyed and their astronomical bearings accurately determined and permanently marked. Along this line, I would suggest that an effort be made to have the interesting paper on "Boundary Monuments" that has been prepared by Dr. Deville for this meeting, published in the press.

I am sure we are in hopes that our remodelled and amended "Survey Act," which has been held in abeyance for the past three years, will receive the favorable consideration that it deserves and become our governing law during the coming session of our legislature.

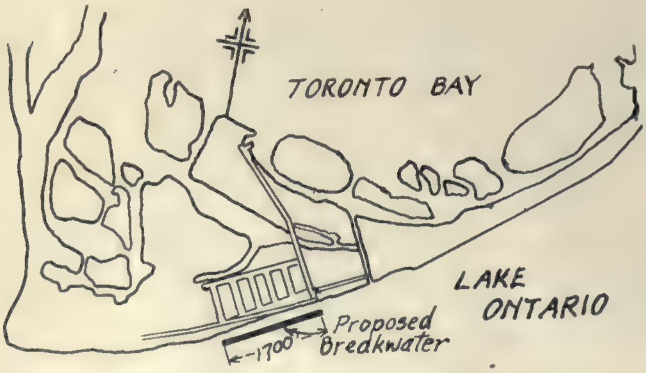
I am sure I am giving expression to the complete satisfaction all our members entertain towards Willis Chipman, our worthy chairman of "Repository and Biography." The work in connection with his report involves an almost endless amount of correspondence and time, but I trust he will not discontinue this good work until he has secured a sketch of all the deceased surveyors.

Stone Breakwater to Protect Toronto Island

Scouring to be Prevented by Rubble Mound Stone Structure 1700 Ft. Long, 200 Ft. From Shore, Built on Series of Fascine Mattresses

MEASURES are to be taken to prevent the scouring of the Lake Ontario shore of Toronto Island. So great has the washing action been in the last few years that there is little left to the original shore and many of the houses along the lake front are in constant danger of upheaval. Action in this matter has been urged for some time and the first steps towards an alleviation of the situation are now being made by the Dominion Department of Public Works, which is calling tenders for a breakwater 1700 ft. long, located at an average distance of 200 ft. from shore.

The work which is to be constructed this year consists of a rubble mound stone breakwater, built upon a series of mattresses, 100 ft. long, by 60 ft. wide, consisting of three layers of brush-wood fascines, secured by wire between pole frameworks and covered with a layer of one-man stone for sinking purposes. The length of the work will be 1700 ft. and the breakwater will be built to a height of 7 ft. above datum, having a width on top of 10 ft., a width at the base varying according to the depth of water below zero of gauge.



South shore of Toronto Island to be protected by breakwater

Mattress Construction

The mattress will be built in sections of 100 ft. in length and 60 ft. in width and will consist of brushwood fascines made 12 inches in diameter, secured top and bottom between frameworks of timber poles, the top and bottom layer of fascines running transversely and the middle layer longitudinally. In building up the mattress the top and bottom framework are to be secured together by wire lashings every 5 feet around the edge of the framework, and every alternate 10 feet where the poles cross in the interior of the framework, the latter wire passing up between the fascines having been secured in position on the bottom of the framework before laying the fascines on it.

The materials used for making the fascines are to be of suitable pliable green brushwood or saplings. The fascines will be approximately 12 inches in diameter when made and will be bound every three feet with two laps of No. 14 gauge wire. They are to be made and placed in the framework in lengths so as not to have more than two joints in each layer over one 5 ft. square panel.

The brushwood fascines will be secured between frameworks made of ballast poles of from 15 to 35 feet in length, these frameworks being 100 ft. long and 60 ft. wide, the poles being spaced 5 ft., centre to centre along the width and length of the framework. These poles are not to have less than 6 in. butts and 4 in. tips; the poles running longitudinally are to break joint not less than 10 ft.; similarly the poles running transversely, i.e., across the 60 ft. width, are to break joint not less than 10 feet. At the same time poles running longitudinally are not to be jointed at any point where a joint occurs in the poles running transversely. At all joints butt and tip are not to lap less than 18 inches, and they are to be bound securely together with wire. At each crossing of longitudinal and transverse pole, there is to be a double seizure of No. 9 gauge wire, tightly bound to maintain the framework rigid.

After the bottom framework has been completed, a double bonding of No. 9 gauge wire, in lengths of 12 ft., is to be tightly wound at each intersection of longitudinal and transverse pole at the sides and ends of the framework and at every alternate intersection for the balance of the framework; the ends of these wire being left upright to form vertical binders through the fascines to the top framework of the mattress where they will be bound to the poles at their corresponding intersection.

Sufficient one man stone are to be provided to sink each mattress, which are to be distributed over the upper surface in such a manner as to sink the mattress evenly.

The breakwater will be built up of rubble mound stones ranging from three to eight tons, a sufficient quantity of smaller stones, ¼ to ½ ton, being provided to fill any voids. The larger stones will be utilized both on the north and south sides to form toe of slopes for the whole length of the breakwater, each stone throughout the work to be carefully placed in such a position as to make as few and small voids as possible, at the same time forming a bond with the adjacent stones. The stones will be so placed to form an approximate slope of 1½ to 1 on the south or lake side of the breakwater and to a slope of 1 to 1 on the inner or shore side.

Spouting of Concrete Has Limitations

Chuting Does Not Ordinarily Require More than Usual Amount of Water but Tends to Separate Aggregate Unless Auxiliary Hoppers are Provided — Rigging Costs May Offset Saving in Placing Costs

By Leonard C. Wason*

THE question of handling concrete through spouting involves consideration of both cost of operation and quality of final product. It involves also questions of the support of the spouting, and in many cases requires a tower so high that it is difficult to provide adequate stiffness. Where all the conditions can be satisfactorily met, there is no good reason in most cases why spouting should not be used, provided the concrete so spouted is delivered into auxiliary hoppers, where it automatically undergoes further mixing before being wheeled into forms.

The Aberthaw Construction Co., however, does not consider it advisable to spout concrete directly into place except when it is for the purpose of placing heavy masses of concrete, such as a large engine foundation, a dam, or the piers and abutments for a bridge. For general building construction, the spouting of concrete from the mixer to a point near the final location of the material is frequently a great help, but considerations of both quality and cost make it usually inexpedient to spout directly into the walls or floors.

Carrying Concrete Across Obstacle

On a new job just being put under way by this company at Dan River, it was found advisable, because of certain local conditions, to place the mixing plant across the canal from the new building. This makes it necessary to carry the concrete in spouts across the canal to a hopper located conveniently for final distribution. The same sort of arrangement has frequently been made when it was necessary to carry concrete from its point of manufacture or mixing across either a street or a group of railroad tracks or a small stream, in order to place it where it is ultimately to rest. In each of these cases the tower is erected on one side of the obstacle and the concrete chutes are suspended from a cableway or other convenient supporting element far enough above the obstacle to clear all possible contingencies, and the concrete shot across to the auxiliary hopper on the far side.

One objection to sending concrete by chutes a long distance is the considerable height of the tower that is required in such a case. Ordinarily the slope or declivity of the chute will have to be about 30 ft. in every 100 ft. In some cases even this figure is exceeded, and the slope may reach as high as 40 ft. This means that the tower will have to be that much higher, for spouting concrete, than it would have to be for delivering it in the ordinary way by wheelbarrows or cars. Not only this, but several feet more have to be added to the tower, because of the height from which the cable support has to be swung. Altogether, a tower for sending concrete to a distance of 200 ft. through a chuting system would have to be perhaps 70 ft. higher than for delivering the same concrete by manual means.

The rigging of the cableway, where it is done by the regular concrete laborers on the job, does not offer many complications, so long as these men are under adequate supervision. When, however, it is attempted to move this unit, so that the concrete may be delivered at a different point, the complications sometimes become considerable. It may even be necessary to dismantle the whole works and set them up again in a new position.

In some cases in city work, particularly where union labor happens to be entrenched, other complications have arisen. For instance, in one case the structural steel union claimed the work of rigging the concrete chutes. The members of this union were, of course, expert in their own particular work of joining together the structural steel members of a building or bridge. They were not, however, especially skilled in handling the concrete chuting plant which they undertook to put in place. As a result, their work did not compare favorably with that of the concrete laborers who had definite experience in that particular work; and as their unit price or wage was twice as great per man as for the laborers, the labor cost of this particular job was also twice as great as previously.

Excess Water for Lubrication

Theoretically, concrete should have about 6 per cent. of its entire weight in the form of water. This is the amount chemically necessary to obtain the reaction at the time the concrete sets. In practice, however, concrete flows so poorly with only 6 per cent. of its weight in water that a much larger proportion is commonly used. Frequently the percentage runs up to 10 per cent. or more, in order to obtain a free-flowing mixture. As the pouring of concrete through chutes naturally requires more water than the handling in wheelbarrows or otherwise by hand, one would suppose that more water would be employed for the concrete which is to be spouted, as compared with that which is to be handled in the more usual manner. Ordinarily, however,, this is not the case. The mixing is made in just about the same way as usual, and the excess water merely lubricates the mixture as it flows down the chute.

There is, however, a large amount of water used when chuting, because of the fact that, to start an easy flow, the chute itself must be thoroughly washed out with a hose, to get rid of particles of cement and sand which would otherwise stick permanently to it. Both these operations introduce appreciable quantities of water into the system, which have to be gotten rid of. They are not wanted in the forms or on top of the newly laid concrete, but must be discharged outside. Sometimes this is easy, but more often it requires a good deal of trouble and some expense to dispose of the surplus water.

Strength Not Affected by Chuting

The excess water used, in practically all concrete, is a decided detriment in so far as strength is concerned, for increasing the water content from 6 per cent. to 10 per cent. reduces the ultimate strength of the concrete by almost half. Inasmuch, however, as additional water is not ordinarily used for chuting as compared with the other practice, the strength, so far as water content is concerned, does not appear to be affected by the chuting process.

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*President, Aberthaw Construction Co., Boston, Mass., in "Concrete."

There is, however, a definite tendency for the mixed concrete to disintegrate to a certain extent in the chutes, the heavier pieces of the aggregate separating from the watery mortar of the cement, sand and water, instead of sticking together all in one mass, which is to become a homogeneous unit in the finished product. This is largely true when crushed stone is used for aggregate, because this will not flow so readily in the chutes as will the round pebbles of a good clear gravel. Consequently gravel is a better medium for chuting than crushed stone.

One method of concrete spouting which overcomes the disadvantages of chuting concrete directly into the forms consists in providing a small auxiliary hopper at the lower end of each section of spout. This is large enough, and subjects the concrete to enough of a fall so that the mixing is done over again at each junction point on the way down the chute. As the sections of the chute are usually about 20 ft. long, there would be half a dozen intermediate mixings in each 100 ft. or 150 ft. length of spout.

Does Not Necessarily Save Labor

This method is frequently used in the effort to reduce the labor cost of transporting the concrete from the mixer to the form. It is not always successful in this direction, however, because the direct labor saved in placing the concrete is, in many cases, more than compensated for by the labor of handling the chutes, and the rental on the chutes themselves.

A special concrete tower designed for chuting operations has been developed, with a cross section in the form of a U, or three sides of an open square. Theoretically this is very good, for the tower hopper may be moved up or down in front of the open space and held anywhere along the height, as may be desired. In practice, however, the tug of the catenary supporting the chutes is so great as to bend the tower down out of position, and make it necessary to introduce separate means of stiffening. In some cases other forces acting upon the tower tend to deform it, so that cross bracing becomes necessary over what was previously the open face. This destroys at once the principal advantage of this form of tower, because it is necessary then to move the braces every time the hopper is raised or lowered.

Keep the Cement Sacks at Work

ONE empty sack at the cement mill is worth any number of them lying idle in dealers' or users' hands all over the country in so far as shipment of cement is concerned. Like many other kinds of cotton goods cement sacks are scarce. If every idle cement sack in the country returned to the plant which sent it out, there would be a considerable relief of the present shortage both of cement and sacks

Besides, cement sacks cost you money—money which is not working for you as long as you keep the sacks in your possession and thus make it impossible for the manufacturer to buy them back.

This condition is simply another one of those seemingly trifling items of neglect, that in its own way is contributing to keeping the wheels of industry from moving as regularly and as smoothly as we all would like.

If a cement plant ships 1,000,000 barrels of cement a year in sacks, 4,000,000 sacks are necessary to take care of this shipment. Under actual conditions when shipments are made every day, the cement plant at the end of the year would find itself short of a very large number of sacks because dealers or cement users have not returned all they received. The following year it would, therefore, be necessary to supplement the stock of sacks by purchasing new ones. Sooner or later some sacks are certain to be lost through neglect or because put to improper use and thereby permanently kept from being again used as cement containers. No one knows exactly what becomes of them, but if lost while in your possession, it means money lost to you.

Many building and highway contractors have shown commendable enterprise in purchasing and storing during the past winter, large quantities of cement in anticipation of immediate need when the construction season opens. Naturally this has temporarily prevented the circulation of many cloth sacks. Nevertheless there are enough empty sacks in users' and dealers' possession throughout the country, which, if returned to the cement mills, would make the number held out of circulation through storage of cement relatively insignificant.

Remember cloth cement sacks represent an outlay of money by you until you have returned them for credit, and if they are not returned promptly, the cement manufacturer must provide for new containers to take care of his business with you. This represents an unnecessary waste because far more containers must be manufactured and used than would actually be necessary if every cement sack was kept at work.

Take care of cement sacks

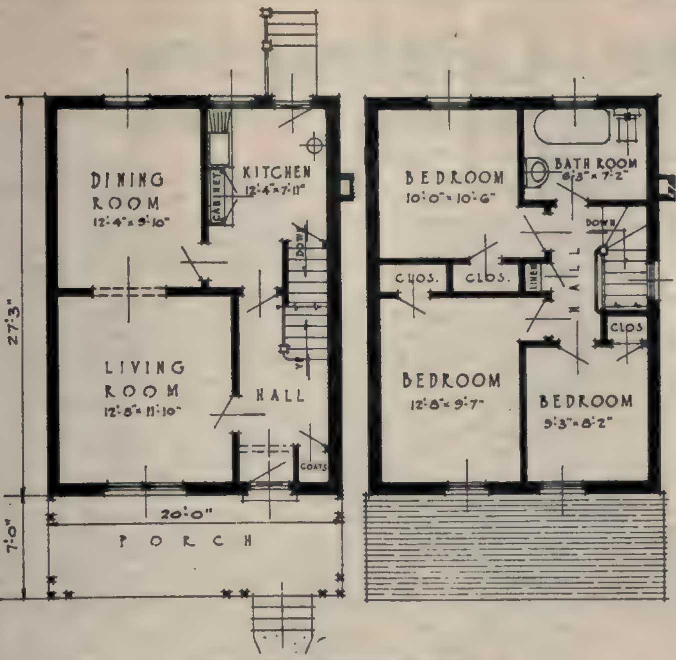
Keep them at work.

Return them promptly so the cement manufacturer can ship the cement you want.

Woodstock Ont., Company to Manufacture Welded Tubing

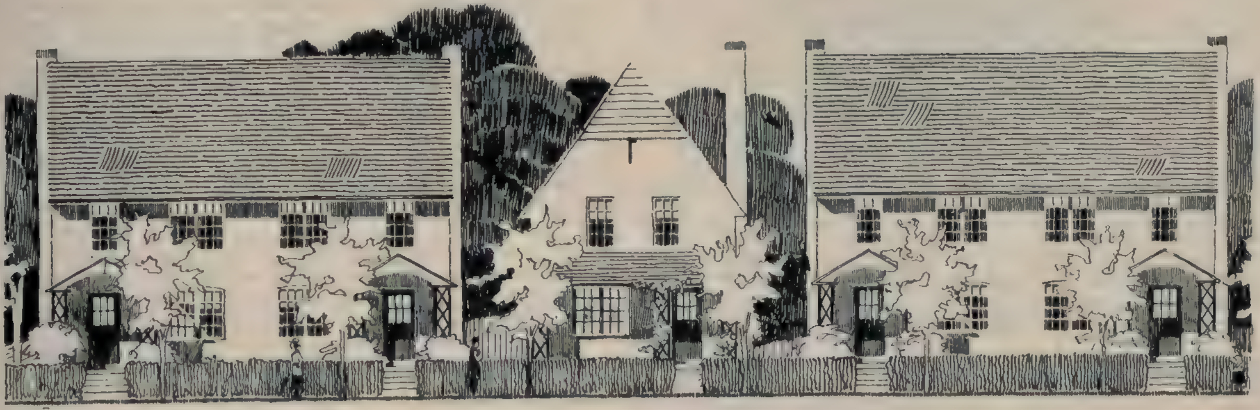
Standard Tube & Fence Co., Limited, of Woodstock, Ontario, have acquired the Canadian patents of Marshall B. Lloyd, covering acetylene and electric welded tubing, and have formed a close working arrangement with the Standard Parts Company of Cleveland, Ohio, to manufacture many of the latter's line of welded products. The Standard Tube Company's product has heretofore been confined to close joint tubing, but with the purchase of the Lloyd's patents, will now be in a position to supply welded tubing required by the automobile, bicycle, bedstead and other trades. Extensive additions to the plant in Woodstock are contemplated for this spring. Meanwhile equipment is being installed in its present buildings and the company expects to be ready in a few weeks to deliver the first welded tubing of this kind made in Canada.

Joncas, Malouin, and Rousseau, Limited, has been incorporated to carry on business as contractors, engineers, and dealers in builders' supplies. The capital is $20,000, and the head office is at Quebec. Messrs. M. P. Joncas, Paul Malouin, and J. E. Rousseau, civil engineers, are interested.

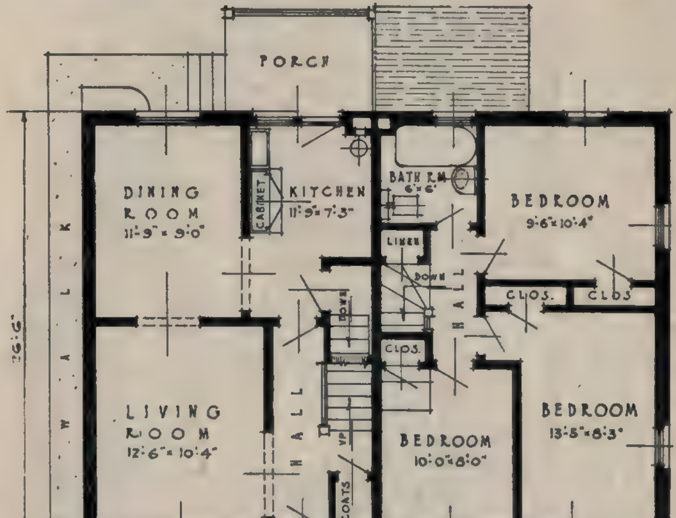


Floor plan of detached house

The accompanying front elevation and floor plans are from designs by William Lyon Somerville, Toronto, and illustrate the type of home adopted by the Leaside Housing Commission for their building scheme. The floor plans are worthy of close study as they embody the latest ideas in the design of homes for those of moderate means. Attention might be called to the total areas of bedroom space as compared to the total area of the first floor. Without sacrificing comfort or convenience all waste space has been eliminated and a maximum amount of room given over to sleeping quarters.



The ground floor is conveniently laid out. A direct passage gives access to the kitchen, from the front entrance, without having to pass through the living and dining rooms. The kitchen contains a built-in cabinet and the sink is placed close to a window, thus insuring a maximum light. The closet just inside the front entrance is very convenient for coats, hats, rubbers, etc. Tenders were called on these plans last fall and the bids submitted varied from $2,500 to $2,755 for the semi-detached houses, and from $2,800 to $3,000 for the detached. As building costs have advanced since that date, it would cost considerably more to erect these homes to-day.



Plan of semi-detached house

Hints for the Contractor

That May Save Him Time and Money—We Will Pay for All Accepted Items—Send One In

Double Acting Elevator Saves Time and Expense on Buildings

By G. Graham Reid*

IN these times a good many engineers are unfavorable to the use of towers and chutes for placing concrete in buildings since there is a constant tendency to increase the water content unduly and thus weaken the structure. The writer has found that a double acting elevator, as sketched, not only gets rid of the objectionable spouting system but actually lessens the expense of handling the concrete, provided the amount to be handled is not too large, as in heavy piers, etc.

The elevator is built to the desired height with two 4 ft. x 6 ft. elevator chutes. Cages are built as indicated and one end of a hoisting cable is tied to each cage and given two winds about a 2 ft. diameter wheel attached to the shaft of a reversible hoist engine. This wheel can be thrown out of gear by a clutch lever and the hoist used for any other purpose while running the elevator. The friction lever is adjusted so that when one cage strikes the bottom the friction slides and the engine does not necessarily need to stop at exactly the right place although with a little practice, the hoist man can operate it properly. The large wheel is necessary to give the elevator speed in going up and down.

An empty buggy is run on the cage at the top and a loaded one at the bottom. The loaded buggy goes up to the work floor and the empty one goes to the ground to be charged at the mixer.

This method, in the opinion of the writer is better than chutes for concrete buildings and the elevator can be used for hoisting any kind of material.

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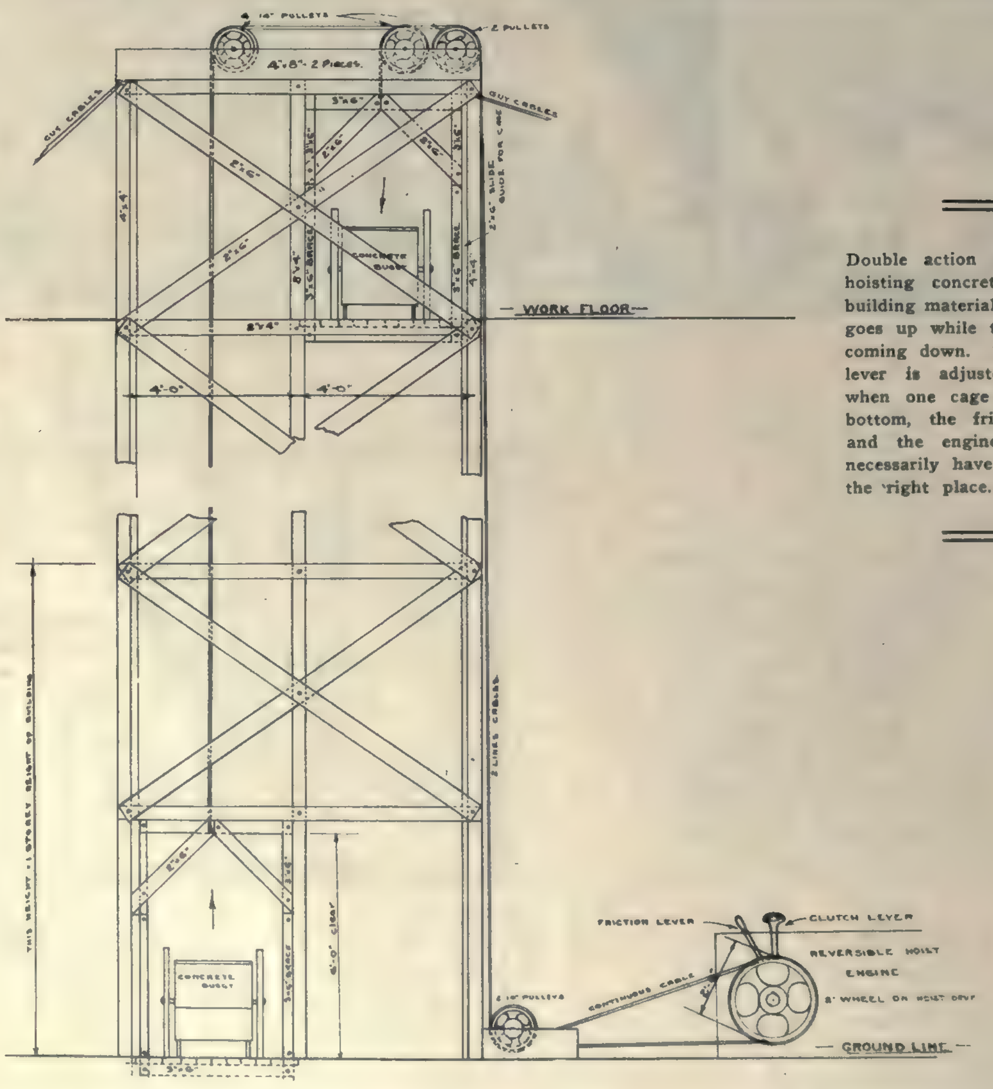
* Contracting Engineer, Toronto.



Double action elevator for hoisting concrete or other building materials. One cage goes up while the other is coming down. The friction lever is adjusted so that when one cage strikes the bottom, the friction slides and the engine does not necessarily have to stop at the right place.

No. 11

Canada's Contractors—E. G. M. Cape

When, six years ago, war engulfed us, Canada's contractors did not hesitate to assume their share of responsibility. Many of them went overseas in various capacities and many returned with honours won for unflinching devotion to duty. Among these is Major E. G. M. Cape, D.S.O., a sketch of whose career we are proud to present this week.

Major Cape is a native of Hamilton, Ontario, where he was born in 1878. He is a '98 graduate in engineering of McGill University, with the degree of B.A.Sc. For a few months following graduation, he was with the Royal Electric Company, and in 1899 was appointed engineer in charge of the Lethbridge Electric Light & Waterworks Company, at Lethbridge, Alta. In 1900 he returned to his alma mater as a demonstrator in engineering, later becoming assistant chief engineer of the Lake Superior Power Company, at Sault Ste. Marie, Ont. He spent the year 1902 in Europe, and in 1903 and '04 carried on a consulting engineering practice in Montreal, his last work in this capacity being the plant of the Canada Car Company, Montreal. From 1906 to the present time he has been in engineering and general contracting work under the firm name of E. G. M. Cape & Company, Limited. This firm has carried out a very large number of contracts throughout Eastern Canada, some of the outstanding ones being: Shipbuilding plant for Canadian Vickers, Ltd., Montreal; manufacturing plant for the Northern Electric Co., Montreal; Ross Memorial Wing, Royal Victoria Hospital, Montreal; office building for Lewis Building Company, Montreal; concrete docks for the C. P. R. Steamships, West St. John, N.B.; Atlantic Sugar Refineries, St. John, N.B.; Bell Telephone Exchange, Quebec, P.Q.; Canadian Explosives plant at Brownsburg, P.Q.; Military Hospital, Ste. Anne de Bellevue, P.Q.; Tuberculosis Hospital, Ottawa, Ont., etc., etc.

Major Cape's military experience dates from the outbreak of war in 1914, when he went in for artillery training, being given the command of the 21st Westmount Militia Battery in April, 1915. He recruited the 3rd Canadian Siege Battery for overseas service in the fall of 1915, taking the battery to France in June of 1916, after a short training in England. The unit served with distinction in the Ypres salient, Somme offensive, battle of Arras, (Vimy Ridge), etc., etc. Major Cape was invalided to England in May of 1917 and was sent home to Canada on sick leave, being discharged as unfit for further military service. He was mentioned in dispatches for distinguished service and devotion to duty on January 4, 1917, and June 1, 1917. The Distinguished Service Order was awarded him on June 4, 1917.

Major E. G. M. Cape, D.S.O.

Cost of Dredging an Old Crib Wharf at Brockville, Ont.

By A. Langlois, B.A.Sc., C.E.*

THE Dominion Department of Public Works had to remove one side of an old timber wharf at Brockville, Ont., and replace it by a pile dock. The crib was of the following dimensions:—281 ft. long, 16 ft. high by 13 ft. wide. On top of it were spread 200 cubic yards of broken concrete and 360 cubic yards of mud. The depth of the water was 18 feet, 2 feet above the crib.

It was decided to dredge it out, the conditions for dredging being fairly good. The stone from the crib and the mud were dumped one mile away, and the old timber piled on the bank, an average haul of 150 feet.

The time required and the material used on the work were as follows:—

Dredge crew, 7 men at 10 days (10 hr. day)	=70 days
Tug crew, 4 men at 10 days	=40 days
Two men hauling timbers at 10 days	=20 days
One man and horse	4 days
Boarding 11 men for 10 days	
Two days for the dredge to get on the job and return.	
Coal, 40 tons.	

The total amount of materials dredged sums up as follows:—2165 cu. yds. of cribwork, 200 cu. yds. of broken stone, 360 cu. yds. of mud; total 2725 cu. yds.

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*Principal Assistant Engineer, Department of Public Works, Ottawa.

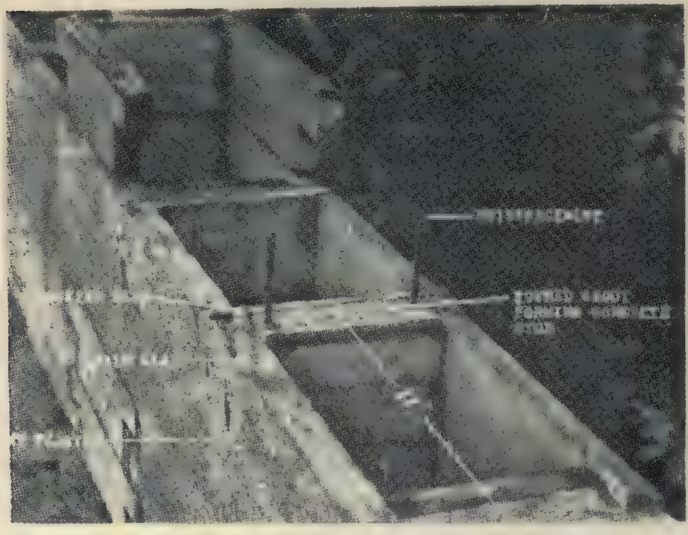
New Type of Hollow Concrete Wall Being Introduced in Canada

A NEW method of hollow concrete wall construction is being introduced in Canada through the Canadian Self-Locking Concrete Wall Co., Ltd. The system, known as the Sawyer System, is the invention of F. McM. Sawyer, an architect of Los Angeles, California. The general principle upon which this scheme is based is described below. The construction is essentially a two piece self-locking sectional wall, practically monolithic in construction, built without the use of wooden forms. The wall consists of two units, namely, the main slab and locking (or key) slab, which are both shaped so that each dovetails into the other, in such a manner, when placed in the wall, that the interlocking part of the slabs forms a space which is poured with grout (concrete) and locks the wall together, forming concrete self-aligning studs or columns, every 16 inches for the full height of the wall.

These columns can be reinforced if necessary to carry extra heavy loads. The cement slabs form two parallel curtain walls, serving to perfect the construction by forming a hollow wall which is moisture proof.

To finish the exterior, a coat of stucco (cement plaster) is applied uniformly on the surface. This is a very satisfactory finish, for the slabs present such uniform surface that the average thickness required is not more than three-sixteenths to one-fourth of an inch. This thin coating, knitting, as it sets, to the concrete slabs, forms a coating which will not crack or check. The coat of stucco, working into the V-shaped grooves of the stud section, knits the wall together into a solid monolithic mass. The plaster on the interior acts in the same way and requires no furring or laths.

When placed in a wall the first procedure is to place a firm foundation reinforced with steel rods, and after the foundation has set sufficiently the concrete slabs and keys are set in place. No mortar is used in between the courses, and the only concrete used while the construction is going up, is the concrete needed to fill the space between the keys, which forms the pilasters or studs. Each pilaster or stud is reinforced with two steel rods, and pilasters are set 16 inches on centers, identical with the construction in balloon frame construction.



The construction of a Sawyer system hollow self-locking wall

When the wall has reached the required height, a cement cap is set in place, also reinforced with steel rods, which are tied into the steel which projects through from the pilasters. At the corners of the structure a solid corner is poured of concrete, which is reinforced with steel rods and these rods carry each way from the corner into the cement cap, which steel, finishes the tying of the entire structure.

The Canadian Self-Locking Concrete Wall Co., Ltd., who control the system in Canada have their temporary office in Seattle, Wash., but will soon establish in Montreal. Plants are being established in Manitoba, Alberta, Saskatchewan and British Columbia.

Montreal Plumbers Must Have License

The Administrative Commission, of Montreal, have added a clause to the plumbing by-law which requires a plumber to obtain a license from the city and a certificate of competence before he can be employed. Further, master-plumbers must furnish the city with the names of their plumbers on demand of the city authorities.

New Book

"Estimating Concrete Buildings," by Clayton W. Mayers. Published by Aberthaw Construction Company, Boston. Price $1.00.

Estimating the cost of constructing concrete buildings is a process concerning which most architects, engineers, and contractors have still much to learn. Indeed, in so far as is known, Mr. Mayer's modest volume is the first to be published on this subject.

Pioneer though it is, "Estimating Concrete Buildings" is an extremely clear and well arranged treatise. Starting with the most elementary considerations, it explains each successive step in estimating a building, part by part. The sum of the parts constitutes a complete estimate, which is reproduced in facsimile. An additional section discusses methods of establishing unit costs.

While the price of one dollar is set upon the book, the Aberthaw Company announces that it will provide free copies to architects and engineers and to technical schools that may wish to adopt it for class room purposes.

Mainly Constructional

East and West—From Coast to Coast

The ratepayers of Simcoe, Ont., passed a by-law recently authorizing the issuance of debentures to the total of $58,000 to cover the cost of constructing four bridges in the vicinity.

A report from Winnipeg states that the T. Eaton Company, Ltd., have commenced the erection of a nine-storey building in that city. The site of the new building is on the corner of Donald Street and Graham Avenue, and the dimensions 348 ft. by 120 ft.

It has been announced that the Saskatchewan Co-operative Elevator Company, Regina, Sask., will build six additional elevators this year, bringing the total number of elevators operated by this company to 322. These elevators will cost in the neighborhood of $16,000 apiece to erect.

It was announced recently that the large plant of the Geo. W. McFarlane Engineering Works, at Paris, Ont., will soon be under operation. Plans are being laid for the construction of 40 houses to accommodate the employees of the plant. It is expected that within a few months upwards of 100 skilled mechanics will be employed at the plant.

City Engineer Adams, of Chatham, Ont., has been given the contract for the installation of a new rapid sand filtration plant for the city. He has been instructed by the Board of Water Commissioners to prepare plans at once so that construction can be undertaken at the earliest possible moment. Mr. Adams is of the opinion that it will take two years at least to instal this plant.

Mr. Geo. T. Clark, Designing Engineer, Harbor Commission, Toronto, gave a very interesting illustrated lecture recently on the progress of harbor developments at Toronto, before the Toronto Branch of the Engineering Institute of Canada. Several pictures were shown portraying the physical difficulties met with and the methods of overcoming same.

The report of the Minister of Public Works, Ottawa, for the fiscal year ending March 31, 1919, shows a total expenditure of $21,395,500, of which $8,492,503 was charged to war appropriation. The expenditure on ordinary account was $1,500,000 less than during the previous year, and within the last four years expenditures had been decreased by $16,280,320. The revenue was $530,482, an increase of $108,990 over the previous year.

The Housing Commission of Guelph, Ont., will ask the Government for an additional $500,000 to carry on housing work in the city this year. The Commission has $184,000 of last year's loan on hand at the present time, but this amount is not considered nearly enough to cover the work planned for the approaching building season.

The Regina Builders' Exchange is in the process of reorganization. At the annual meeting held recently it was decided to organize on a trade section basis, each trade section to deal with problems peculiar to that section. There will be an executive body, composed of a president and vice-president, and an executive committee will be appointed, composed of one member from each trade section, when the different sections have organized. A resolution, to change the name of the organization to Association of Construction Industries of Regina, was proposed. This matter, however, was passed on to the Provincial Council for consideration. R. J. Lecky was elected president and A. E. Long, vice-president.

Tenders have been called for the construction of a seawall at Toronto Island and the plans are now at the Toronto office of the District Engineer, Dominion Dept. of Public Works. If tenders are satisfactory, it is expected that this project will be gone ahead with this summer in order that the wall will be completed in time to protect the Island shore from the Autumn storms. The wall will be built 200 ft. out from the shore and will be 1700 ft. in length, stretching from the foot of Pawnee Ave. east to a point beyond the foot of Manitou Rd. The new wall will be built on a brush-wood fascine mattress foundation, three feet thick and sixty feet wide, while the wall itself will be 47 feet wide at the base, fifteen feet in height from the top of the foundation and ten feet wide on the top.

Personal

Mr. C. B. Smith has been appointed Roads Inspector of Sherwood Municipality, Saskatchewan.

In the absence of City Engineer Fellowes, of Vancouver, who is on a business trip to Ottawa, Mr. Edward LeFlufy, waterworks engineer, is acting city engineer.

Mr. A. M. West, City Engineer of North Vancouver, B. C., has resigned to go into private business, his resignation to take effect April 15. Mr. West has been in the employ of the city since 1913.

The Municipal Council of Burnaby, B. C., has appointed Mr. Ernest Smith, of Edmonds, B. C., as municipal engineer. There were five applications altogether for the position. Mr. Smith is a returned man.

Mr. David Hanna, chief of surveys and drafting, Roadways Department, Toronto, has resigned this position to accept the appointment of Superintendent of Waterworks at Windsor, Ont.

Mr. M. N. McDowall, Street Commissioner of Owen Sound, Ont., celebrated his 30th anniversary in this position recently. Mr. McDowall succeeded his father as street commissioner in 1890. The Town Council commemorated the anniversary by granting Mr. McDowall a substantial increase in salary.

Mr. H. Springer, formerly municipal engineer of St. Vital, Man., who has just recently returned from overseas, has been appointed engineer in charge of the road building programme of the municipality of Dauphin, Man. This programme, which covers a period of three years, includes the construction of 60 miles of new roads during the present year.

Major E. G. M. Cape, contractor of Montreal, has been nominated by the Montreal Administrative Commission as the English speaking member of the Montreal Charter Commission, authorized by the Quebec Government to report on the Civic Government of Montreal. The Administrative Commission was authorized to nominate two members to the Charter Commission.

Mr. Brien Douglas McConnell, C.E., of Montreal, was recently presented with an illuminated address and a gold headed walking stick, by the members of the Quebec Land Surveyors' Association, on the occasion of the fifteenth anniversary of his entry upon his professional career. Hon. J. P. B. Casgrain, president of the association, read the address, while the presentation of the walking stick was made by Mr. Thomas Kirk.

Obituary

Mr. Harry Sinclair Scott, employee of the Ontario Public Works Department, Ottawa, died recently in that city as a result of a runaway accident, in which he was thrown, from the cutter he was driving, against a telephone pole, fracturing his skull in two places. Mr. Scott was superintendent of construction at the Ontario Hospital, Ottawa.

Daniel Bernard McCarthy, for the last six years Eastern sales manager of the Neptune Meter Company, died at his residence, 35 Fort Washington Avenue, New York, Saturday afternoon, March 6th, after an illness of bronchial pneumonia, with other complications. Mr. McCarthy was born in Wevertown, Warren County, January 1, 1871. Upon entering business he elected the contracting and construction line, finding his first employment with Moffett, Hodgkins & Clark of Watervliet. He was with them in the management of their various waterworks properties, being stationed in Watervliet for about a year in charge of the waterworks plant. He then moved to Waterford and became superintendent of the Waterford Water Company, continuing in that capacity for nearly twenty-one years, until the town purchased the private water company. During his management of the private water company he associated himself with the Neptune Meter Company, and represented them as a travelling representative for seventeen years, covering many of the Eastern States and most of Canada. In May, 1914, he was made Eastern sales manager of the company and was in direct charge of sales for a large portion of the country. He was very popular with the waterworks trade, and was held in very high esteem by those with whom he associated.

Trade Incorporations

East St. John Building Company, Limited, with head office at East St. John, N. B., capital $24,000.

The Toronto Electrical Contractors' Association held their regular monthly meeting and dinner in the Hotel Mossop on Thursday evening, January 8. The chief topic up for discussion was the wage schedule for the year 1920. It was finally decided to offer 85 cents per hour, beginning January 19. This figure has since been accepted by the men.

The total revenue of the Welland, Ont., hydro department for the nine months ended September 30, 1919, was $61,948. Operating expenses were $56,939, leaving a net surplus of $5,308.

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks, Sewerage and Roadways

Amherstburg, Ont.
Town has under consideration the construction of sewer. Mayor, Mr. Park.

Amos, Que.
By-law authorizing expenditure of $10,000 on construction of sidewalks and $35,000 on construction of sewer for Town will be submitted. Secy.-treas., H. Authier.

Halifax, N. S.
Tenders will be received until noon, April 7th, by Provincial Highway Bd., Parl. Bldgs., Halifax, for construction of waterbound macadam road on section of Halifax-Windsor Highway from Mt. Uniacke Station to point near Lakelands, a distance of about five miles. Plans at office of Chief Engineer.

Hamilton, Ont.
City contemplates expenditure of $13,000 on filling in of inlet, $25,000 for construction of asphalt plant, $40,000 for opening up of new street and $100,000 on improvements to sewerage system. Engineer, E. R. Gray.

Hensall, Ont.
Harry Strong, Clerk for Osborne Township, R. R. No. 1, Hensall, Ont., has plans and receives tenders until March 25th for construction of Winchelsea Creek Drain.

Kitchener, Ont.
B. G. Mitchell, city engineer, has plans and receives tenders until noon April 1st for supply of vitrified sewer pipe, cement, gravel and sand, castings, crushed stone and screenings, concrete tile, refined tar and road oil.

Leamington, Ont.
Tenders are being received for pavement for Town. Clerk, R. M, Selkirk. Plans are being prepared and tenders will be called also for sewer.

Londesboro, Ont.
John Fingland, clerk for Hullett Township, receives tenders until April 2nd for construction of Murray-Lamb Municipal Tile Drain.

Montreal, Que.
City contemplates the expenditure of $1,207,862 this year on repairs to streets, etc. Clerk, Rene Bauset.

Port Dalhousie, Ont.
Town has under consideration the construction of sewerage system costing $30,000. Clerk, J. M. A. Waugh.

Seaforth, Ont.
M. Murdie, clerk, Seaforth, has plans and receives tenders until April 10th for construction of Dolmage and Dickson drains for Hullett and McKillop Townships.

Ste. Elizabeth, Que.
A. Barrette, secy.-treas. to Municipality, has plans and receives tenders until March 26th for gravelling roads.

St. Lazare, Man.
J. E. Selby, secy.-treas. for Municipality of Ellice, receives tenders until 4 p.m. March 27th for draining and grading two miles of road.

Stonewall, Man.
V. W. McFarlane, secy.-treas. for Rockwood Municipality, Stonewall, Man., receives tenders until April 21st for ditching and grading about 100 miles of roads. Plans with engineer, D. M. Mawhinney, Stonewall, and Highway Commissioner, Winnipeg.

Truro, N. S.
Town has under consideration construction of concrete sidewalks costing $5,000, sewers and drains costing $15,000 and also extension to water system. Clerk, Horace McDougall.

CONTRACTS AWARDED

North Lancaster, Ont.
McDonald & McLeod, Dalhousie Station, Que., have general contract for roads costing $30,000 for Lancaster Township. Clerk, A. J. Macdonald, South Lancaster.

Owen Sound, Ont.
Warren Bituminous Paving Co., McKinnon Bldg., Toronto, have general contract for paving costing $90,000 for City.

Welland, Ont.
Somerville & Dilworth, 12 Main E., Welland, have general contract for extension to waterworks costing $12,000 for Crowland Township.

Railroads, Bridges and Wharves

Banff, Alta.
Dominion Dept. Public Works will readvertise tenders next summer for $190,000 bridge over Bow River. Secy., R. C. Desrochers, Ottawa, Ont.

Calgary, Alta.
J. M. Miller, city clerk, receives tenders until 1 p.m. April 15th for special work on street railway. Specifications with Electrical Engineer, City Hall.

Chatham, Ont.
Dominion Dept. Public Works plans to make repairs to breakwater. Secy., R. C. Desrochers, Ottawa.

Cloverdale, B. C.
B. C. Electric Railway Co. contemplate construction of ten miles of standard electric tram line from Cloverdale to Blaine and White Rock, B. C., costing $50,000 to $75,000. Surveys are being made.

Hamilton, Ont.
City contemplates expenditure of $5,000 on construction of addition to dock. Engineer, E. R. Gray, City Hall.

St. Augustin-Deux Montagnes, Que.
Mathias St. Jacques, secy.-treas. to Municipality, has plans and receives tenders until March 30th for concrete bridge.

St. Brigide, Que.
Town plans the construction of bridge. Work will be done by day labor. Secy.-treas., Amedee Brain.

Toronto, Ont.
R. C. Desrochers, secy. for Dominion Dept. Public Works, Ottawa, receives tenders until noon April 12th for construction of rubble mound stone breakwater built upon brushwood fascine mattress, off south shore of Toronto Island. Plans at Dept., Ottawa, at offices of District Engineers, Equity Bldg., Toronto, and Shaughnessy Bldg., Montreal, Que.

CONTRACTS AWARDED

Fairmont, B. C.
A. G. Creelman & Co., Golden, B. C., have general contract for highway bridge costing $4,452 to be constructed over Dutch Creek near Fairmont for Provincial Dept. Public Works.

Meteghan, N. S.
Work will start on construction of ell to breakwater for Dominion Dept. Public Works: General contractors, A. W. Giroir & W. F. McKinnon, Antigonish, N. S.

Nesbitt, Man.
E. Fulcher, Brandon, Man., has general contract for bridge for Municipality of Oakland.

Rosetown, Sask.
Canadian Construction Co., 803 McArthur Bldg., Winnipeg, have general contract for grading on Rosetown and Milden Branches for C. P. Rly., Montreal.

St. Clements, Man.
M. Kelly, Agnes St., Winnipeg, has general contract for bridge for Rural Municipality of St. Clements.

Thamesville, Ont.
Chas. Hubbell has general contract at $15,165 for Duffis Creek Bridge for Kent County Council.

Public Buildings, Churches and Schools

Almonte, Ont.
Richards & Abra, 126 Sparks St., Ottawa, have been appointed architects and are preparing plans for hospital addition costing $10,000 for Rosamond Hospital. Address Dr. T. R. Paterson.

Ardath, Sask.
David Webster, architect, C. P. R. Bldg., Saskatoon, is preparing plans for school costing $34,000 for School Board. Secy.-treas., J. W. Horne, Ardath.

Brantford, Ont.
Jewish Synagogue contemplates erection of synagogue costing $20,000. President, Max Harris, 31 Peare Ave.

Brockville, Ont.
W. B. Scace, secy. to School Board, receives tenders until March 26th for

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Compensation for Losses on Contracts Would Set Dangerous Precedent

WITHOUT weighing the merits of one method of tendering against another, it might be stated that the one recognized disadvantage of the lump sum contract is the element of speculation which enters into all work carried out on that plan. We are strongly in favor of payment for services rendered. Any system of doing work in which payment is not made on the basis of the amount of work done cannot be too strongly condemned. True, of course many contractors prefer to "take a chance," trusting in their own skill and judgment to ensure a fair profit. However, the unforeseen frequently upsets the best of calculations and the contractor who thought he stood to make a fair margin on a lump sum estimate sometimes incurs a loss through circumstances underestimated and frequently unknown. It is thus that the "take a chance" attitude is tested out. Men like to take a chance, if the profit is reasonably sure, but, if a loss is more likely they desire more certain ground. A Toronto contractor happens to be in this regrettable condition. On work for the city he has incurred a loss of $45,000 and has requested the city to compensate him to that extent. He claims this loss was sustained through an under-estimation of certain factors vitally affecting the work. We note that some of the civic officials are favorable toward compensating the contractor referred to, but a dangerous precedent will be established by so doing. If this contractor presented his bid in good faith, he should be required to stand by it and "take a chance" on making a profit—the "take a chance" process ought to work both ways. Of course he desires compensation, but should it be granted him, it will only lead to a condition where tenderers on city work will vie with each other in submitting low bids, confident that the city will compensate the successful contractor for any loss which he may incur. The city cannot afford to set a precedent of such far-reaching effect. Either the contractor must be content to take the risk of possible loss or a new scheme of tendering must be adopted which will eliminate risk.

Are Architects Justified in Increasing Their Scale of Charges?

ARE architects justified in increasing their fees? This is a very pertinent question in view of the movement, noticeable in many quarters, which aims at the adoption of a more remunerative scale of charges for architectural services. Action along this line has just been taken by the Ontario Association of Architects, the council of which association decided last week to revise the schedule of charges heretofore accepted. According to an announcement in the news column of this issue, the members of the Ontario Association will now charge five per cent., instead of four, for services in connection with factories and large buildings involving no detail interior finish; six per cent., instead of five, in the case of office buildings, warehouses and other structures of like character; and eight to ten per cent. for residence work, where the former charge was seven to ten per cent.

We ask again if the profession is justified in making these advances. Not from the cost of living viewpoint, for the architectural profession is in that peculiarly fortunate position where its income is directly proportional to and increases with the cost of construction, which corresponds pretty closely with the cost of living. The only legitimate reason, therefore, for any advance in the scale of fees should be based on an increase of the value of the services rendered. The Ontario Association, in justifying its new proposal, adopts this attitude, and contends that architects to-day are called upon and expected to give greater services, which should be rewarded by greater emolument.

Perhaps it is open to question if architects, as a body, are performing any more valuable service than they did some years ago, as it is questionable, too, if, as a class, they are performing the maximum service of which they are capable. An increase in fees can be justified only if the results of their efforts are so valuable as to command a higher reward. In the opinion of many in the construction business, architects have yet to prove that their services are all sufficient for the needs of the industry. That is not our contention. That they can be dispensed with, however, is proven by the very fair success with which certain large construction companies are designing the buildings they erect. Many owners make use of concerns which perform all services—architectural, constructional and supervision. In the field of house construction, architectural co-operation has frequently been dispensed with. It is thus obvious that the architect is not the indispensable factor he sometimes claims to be.

The members of the architectural profession view with some alarm so-called infringements on their rights, but if the contractor or the engineer, or the owner, for that matter, can perform the architectural services as well as a specialist, he should be at perfect liberty to do so without being considered guilty of trespass. If they want to prevent this so-called encroachment, architects have only to demonstrate that their services are so valuable that they cannot be dispensed with. They must prove to owners that they give a service that is worth paying extra for. When they shall have done that, then they will be in a position to demand a financial return commensurate with the functions they perform. The architectural profession has big opportunities and big responsibilities, provided it develops a service which will mean better, safer and more artistic buildings. Let them demonstrate their ability to cope with these problems satisfactorily.

What we have said does not apply to all architects. It does apply to many—probably the majority. Our suggestion would be that the architects' associations strive first to raise the standard of the service they render. At the present time these services are worth up to 10 per cent., or more, in a few cases, but some, again, are not worth so much.

Townships in Ontario To Receive Generous Road Building Assistance

HON. F. C. BIGGS, Minister of Public Works and Highways of Ontario, has introduced legislation which will set aside two million dollars as a fund from which loans may be made to the townships for improvements to roads within the municipalities. The loans will be repayable without interest within a period not exceeding five years.

This money to townships is plus the regular grants. The Minister of Highways will say how much will be loaned to any township, and it must not exceed an amount equal to ten mills on the equalized assessment of the township. The Government will undertake to accept municipal debentures as security, and these will not require the approval of the electors or be the subject of other restrictions generally applied to debentures.

In addition to the proposed loans the new legislation would reimburse townships for twenty per cent. of their own expenditure on township roads. The Government retains a right of supervision over the expenditure. The bill also gives assistance to the townships by making grants of 40 per cent. of the salaries of township overseers or foremen on road construction.

Suburban road grants are also fixed. In areas just outside the city limits 30 per cent. will be paid by the county; 30 per cent. by the city, and 40 per cent. by the province. The limit of expenditure is one-half mill on the dollar for the city, but provision is made that two mills on the dollar may be spent if the Council approves by a two-thirds vote. The council of the county must be prepared to spend an amount proportionately.

Ontario Municipalities to Finance Their Own Housing Schemes

REPEAL of the "Ontario Housing Act, 1919," is indicated by the introduction of a new bill in the legislature of Ontario, by Hon. H. C. Nixon, Provincial Secretary. The present housing act has depended for its success on the appropriation made by the Dominion Government for housing purposes, Ontario's share of which was $8,753,000. As the Dominion Government has intimated that no further assistance may be expected, the province has decided to proceed on the new lines laid down in the revised bill.

The province's share of the Dominion grant, together with an additional $2,000,000 added in an informal way by the province itself, has already been appropriated to 66 municipalities, and, while a number of these have not proceeded on their schemes, the appropriations still stand and will be applied to work which will be inaugurated this season. The new bill contemplates the continuance of support to the municipalities now at work, until the full amount of the Dominion appropriation has been expended. A time limit is fixed, after which, if the municipalities have not used their grants, they will be appropriated to others which are exceeding their original building programs. It is quite possible that many municipalities which contemplate some development this year will decide to abandon their plans in view of the increased cost of building and the grants made available to them will, therefore, after a specified time, be turned over to other municipalities in need of money for active construction.

The essential feature of the new bill is the fact that municipalities may continue to carry out housing developments by doing their own financing. They will be entitled to apply for provincial endorsation of their bonds and secure the advice and assistance of the provincial housing department.

Of the $10,629,000 appropriated to the municipalities under the "Ontario Housing Act, 1919," only $2,808,000 has been actually paid by the province, so that there is a very considerable amount yet to be given on account of schemes inaugurated under this act. Recognizing that the increase in cost of building has prevented many municipalities carrying out their original plans, the province has decided to raise the loan schedule under the present legislation. Hereafter the province will approve loans up to $3,500 on houses of frame construction instead of $3,200; $4,000 instead of $3,800 on houses of brick veneer construction; and $4,500 instead of $4,000 on those of solid brick construction. If the cost of the land is included, these loans are $4,100, $4,600 and $5,100 respectively.

In his annual report Mr. J. A. Ellis, Director of Housing for Ontario, states that if all the requirements of the various municipalities for this year are

No. 17

Canada's Engineers—P. L. Pratley

If any one class of engineer should be picked out as worthy of special credit for the economic development of our country, it would be the bridge builder. Canada is a land where the predominating problems concerned in its development are those of transportation. Railways and highways, thousands of miles of them, spread across the country, linking up the remote corners of a vast area into one integral unit, and wherever a railroad or a highway penetrates, there bridges are essential. We have them of every type—the tiniest culvert to the leviathan Quebec—each of them, nevertheless, a product of engineering skill and ingenuity and a tribute to the ability and energy of the bridge builder and designer.

It is fitting, then, that as the subject of this week's sketch, we should select one of Canada's well known bridge designers, Philip Louis Pratley, M. Eng., M. Inst. C. E., M. E. I. C. Mr. Pratley was born in Liverpool, England, in 1884 and received his education at the Liverpool Institute and the University of Liverpool, entering as "Council Scholar." He graduated as Bachelor of Engineering, with first class honors, becoming a "Rathbone Medalist" and "University Scholar" and obtaining the Master's Degree after the requisite practical experience. With the intention of taking up mining, he devoted his vacations to working in the lead and zinc mines of North Wales. He also had some training in building construction with his father, a building contractor in Liverpool. Following his graduation from the university, Mr. Pratley served in the bridge shops of Francis Morton & Co., Garston, Lancashire, Eng., until coming out to Canada as designing draftsman with the Locomotive & Machine Company, of Montreal, (now defunct). He joined the designing staff of the Dominion Bridge Company in May, 1906, and, after experience in detailing, checking and designing, he went to the Government Board of Engineers for the Quebec Bridge, as calculating and designing engineer, concerned particularly with the intricate mathematical work in connection with primary and secondary stresses in the various designs which were studied and figured, these including both cantilever and suspension types. On the formation of the St. Lawrence Bridge Company, Mr. Pratley was appointed to their staff as designing engineer and, in that capacity, had charge of all stress sheets and material diagrams for the various designs submitted by them. After the submission of tenders, he returned to the Government Board and took part in the examination and checking of the designs handed in to them. In December, 1910, he was offered and accepted the position of Assistant Designing Engineer to the Dominion Bridge Company, in 1913 succeeding to the full charge of the estimating and designing department as Designing Engineer.

Mr. Pratley has had many large and important bridges pass through his hands. The principal individual structures are, perhaps, the Lachine Bridge, on the C. P. R.; the St. John, N. B., Arch; the Port Nelson Bridge, on the Hudson Bay Line; the Kildonan Bridge, on the C. P. R., near Winnipeg, and a series of bridges on the C. N. P. R. in British Columbia. In addition to bridge work, he has given attention to the construction of steel buildings of all descriptions, industrial plants, mine structures, etc. The Creighton Mine head frame and crusher house, belonging to the International Nickel Company, perhaps the biggest in America, and the head frames at the Dome and Hollinger gold mines in the Porcupine area are important examples of this latter class of work. Under Mr. Pratley's direction are also carried out investigations of existing bridges and structures, estimates of quantities and costs, designs for tenders and for construction and sketches and details for manufacture and erection. In 1917 Mr. Pratley was given charge of the engineering work in connection with a special war venture, the building of marine boilers. As engineer of the boiler department, he has designed and superintended the manufacture of boilers for the British Admiralty and the Canadian, French and United States Governments. This work is now almost finished, being substantially an emergency undertaking.

Mr. P. L. Pratley

He is a member of the Engineering Institute of Canada and member of the Institution of Civil Engineers and author of two papers to the latter institution; one on the Boucanne River Viaduct, (1913), and the other the St. John Arch, (1920), just being published. Mr. Pratley is an enthusiastic advocate of a universal language for purposes of engineering and science in general, and, in this connection, is a member of the Universal, British, and North American Esperanto Societies, and vice-president of the Montreal Society.

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met, $8,000,000 more will have to be appropriated. Apparently the province is not prepared to advance this sum, and the proposed legislation throws the responsibility for financing on the municipalities themselves.

International Town Planning Congress

Delegates, appointed by the Governments of Great Britain, France, Belgium, Italy, Holland, Denmark, Norway, Sweden, Switzerland, Spain, Serbia, Greece, Egypt, India, South Africa, Australia, Canada, the United States, and the republics of South America, will be present at the International Town Planning and Housing Congress to be held in London during June of the present year.

The proceedings of the congress will occupy nine days, special trains being made available so that the delegates may have an opportunity to inspect the progress that has been made in housing schemes.

A Housing Commission, consisting of Mayor W. S. Davis, Messrs. M. J. Butler and W. S. Savage, has been formed at Oakville, Ont., and work will commence as soon as government funds are available. The Commission has already 23 applications for houses on hand.

Canada's First Successful Activated Sludge Sewage System at Brampton, Ont.

Plant Has Operated Excellently for Several Months—Old Septic Tank Rearranged as Aeration Chamber—Small Job, but Contracting Features Unusual

By G. Graham Reid*

IN 1908, the town of Brampton, Ont., as a result of numerous lawsuits brought against them for contaminating the Etobicoke Creek by dumping sewage and other refuse therein, installed a pair of reinforced concrete septic tanks. These were about 100 ft. long with reinforced arch roofs and fitted up to keep all air away from the sewage and allow it to settle and ferment. The fact that the air was kept away was, no doubt, partially due to the desire to keep down the offensive odor, but the main idea was that, if the sludge were well rotted, it would not contaminate the river. They succeeded in keeping the sludge from the creek to some extent, but the effluent was very offensive, making the water unfit for animals to drink, with the result that the farmers, particularly one living on the river bank near the septic tanks, again brought suit for damages.

Septic Tanks Created Nuisance

These old tanks were so arranged that the sewage could be turned into one while the other was being pumped out and cleaned. This was a very disagreeable job on which it was hard to get men to work—a source of constant annoyance to the town council. The sludge, when deposited in the drying beds which were near at hand, was very offensive, and, in spite of the fact that the tanks were at the town limits, the people thereabouts were unanimous in condemning the system. It was, therefore, generally felt that something should be done to alleviate the nuisance and put the town in the good graces of the Provincial Board of Health. Finally, the farmer above referred to, obtained an injunction against the town prohibiting them from dumping sewage into the river after November 1st, 1918. This was afterward extended by the court to February 1st, 1919, to allow for the completion of the plant. The Provincial Board of Health issued a mandate on the question as well and it was, therefore, up to the council to do something in spite of the fact that only nine years previously a considerable sum had been spent in a well-meant effort to relieve the nuisance.

The town engineer, Mr. W. M. Treadgold, was asked to report on the subject, and, after due consideration of all the circumstances, decided in favour of an activated sludge plant. The committee appointed by the council to deal with the matter visited several plants then in operation, including the experimental sludge aeration plants of the Provincial Board of Health at Toronto and of the Guelph Experimental Farm as well as the plants in operation at London and Port Colborne, Ont.

Old Tank Used as Aeration Chamber

Mr. Treadgold then conceived the idea of altering one of the old tanks so as to use it for an aeration chamber, adding a settling tank at the end. By deepening the western one of the old septic tanks, making it approximately 3 ft. 1½ in. wide at the bottom and installing filtros plates supported by 1½ in. x 1½ in. angles, it was planned to aerate the sludge in this chamber. As shown in the longitudinal section, the tank in question was divided into separate main compartments, each an aeration chamber in itself emptying through the by-pass at the west side into the settling chamber. A stop-log was provided at the central wall and by closing this and operating the shear gate the sewage may be turned into either chamber and the other one cleaned out and repaired. The old tank was provided with 12 in. cross walls at 16 ft. centres making six sections in the length of it and these walls, with the exception of the centre one, were left open at the bottom so as to force a thorough circulation of the sludge while passing through the aeration chamber.

Filtros plates, supplied by the General Filtration Company of Rochester, N. Y., were installed in three rows at the bottom, being supported on 1½ in. x 1½ in. angles fastened by means of a bolt and washer at the corners. The joints were filled in with heated cement, round rods, ½ in. in diameter, being laid longitudinally over the angles in the longitudinal joints and the cement poured over them. These filtros plates have proven here as well as elsewhere, particularly in Milwaukee, to be very satisfactory diffusers. They are a composition of silica and although very porous, they are nevertheless very hard and resist the action of any acids in the sewage as well as quartz glass. They cost about $3 per square foot in this country as there is a heavy import duty imposed upon them.

Pipe Line Installation

A walk supported on wood beams ran along the centre of the tank as shown in the cross-section. This was renewed and the piers under it extended to one side to hold a sludge return line and to support 6 in. x 6 in. concrete posts for the 5 in. air line. These lines and their supports running along the walk can be seen in the accompanying illustration of the interior of the activating tank. Two-inch branches run down from the air main and branch at the bottom into two 1 in. lines which open at intervals under the filtros plates. Globe valves are provided at each one of these 2 in. lines so that the air can be shut off any section of the tank. In order to get rid of any water that might leak through the filtros plates when the air is shut off, a one inch blow-off pipe is provided for each section with its valve on a level with the platform. A 6 in. cast iron pipe is laid underneath the activating tank extending into each main chamber and is provided with a 6 in. mud plug, as described in the Chapman valve catalogue. This pipe leads through the wall of the settling tank into a sump just outside the tank and is arranged so that the activating chamber can be pumped dry by opening the mud plugs and pumping from the sump into the nearby sludge bed.

The emergency by-passes which were provided as already mentioned in order to use either main chamber of the aeration tank separately were fitted at both ends with shear gates so that the sewage could be turned from the inflowing manhole, either directly to the river in case of flood, through the unchanged section of the old septic tank to the river, into either chamber of the activating tank or directly into the new settling tank. This was thought ample provision for any emergencies that might occur and so far has proven to be so.

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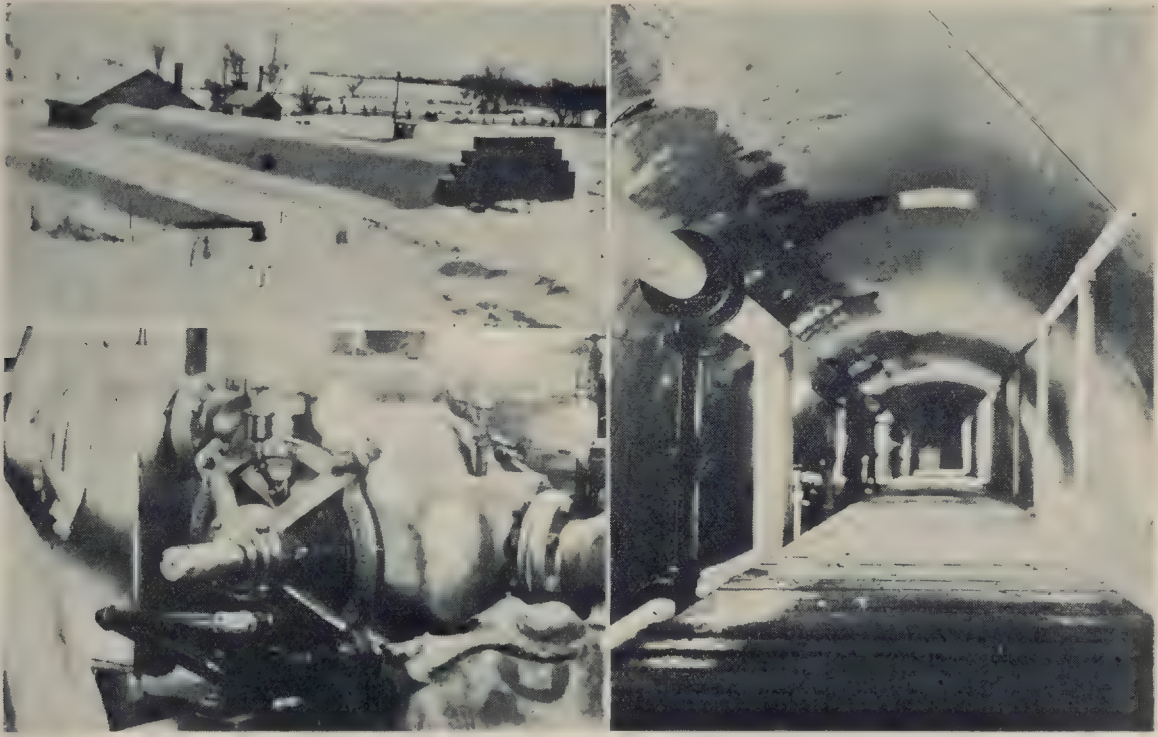
*Contracting Engineer, Toronto

Four old manholes on the side of the activating tank were cut down and fitted with steel sash glazed with wired glass. Two ventilators were also built on the roof in order that the place might be as inoffensive as possible.

Settling Tank and Compressor House

The settling tank at the end was built 16 ft. x 30 ft. inside and 22 ft. below the water level. It was designed with two chambers, each having a 4 ft. x 4 ft. pocket at the bottom into which the whole tank slopes. Reinforced concrete walls 16 in. thick were used and it was thought wise to reinforce these walls heavily as the inward pressure of the quicksand when the tank was empty could scarcely be estimated. The tank was floored over at the ground level by means of two reinforced concrete beams and a 5 in. slab and the compressor house was built on top of it. Collecting weirs of 2 in. x 10 in. cypress were installed; over the edges of these the effluent flows and is collected in a main reinforced concrete weir built on the central wall of the settling tank. A large baffle board of 3 in. x 10 in. cypress was built across both chambers forcing the flow of the sewage towards the bottom of the tank where the sludge remains. A six inch pipe extends to within one foot of the bottom of the tank and is fitted with a ¾ in. air pipe extending inside it below the level of the filtros plates in the activating tank. The air from the compressor was designed to lift the sludge and discharge it outside at the drying bed or back through the sludge return line into the activating tank again.



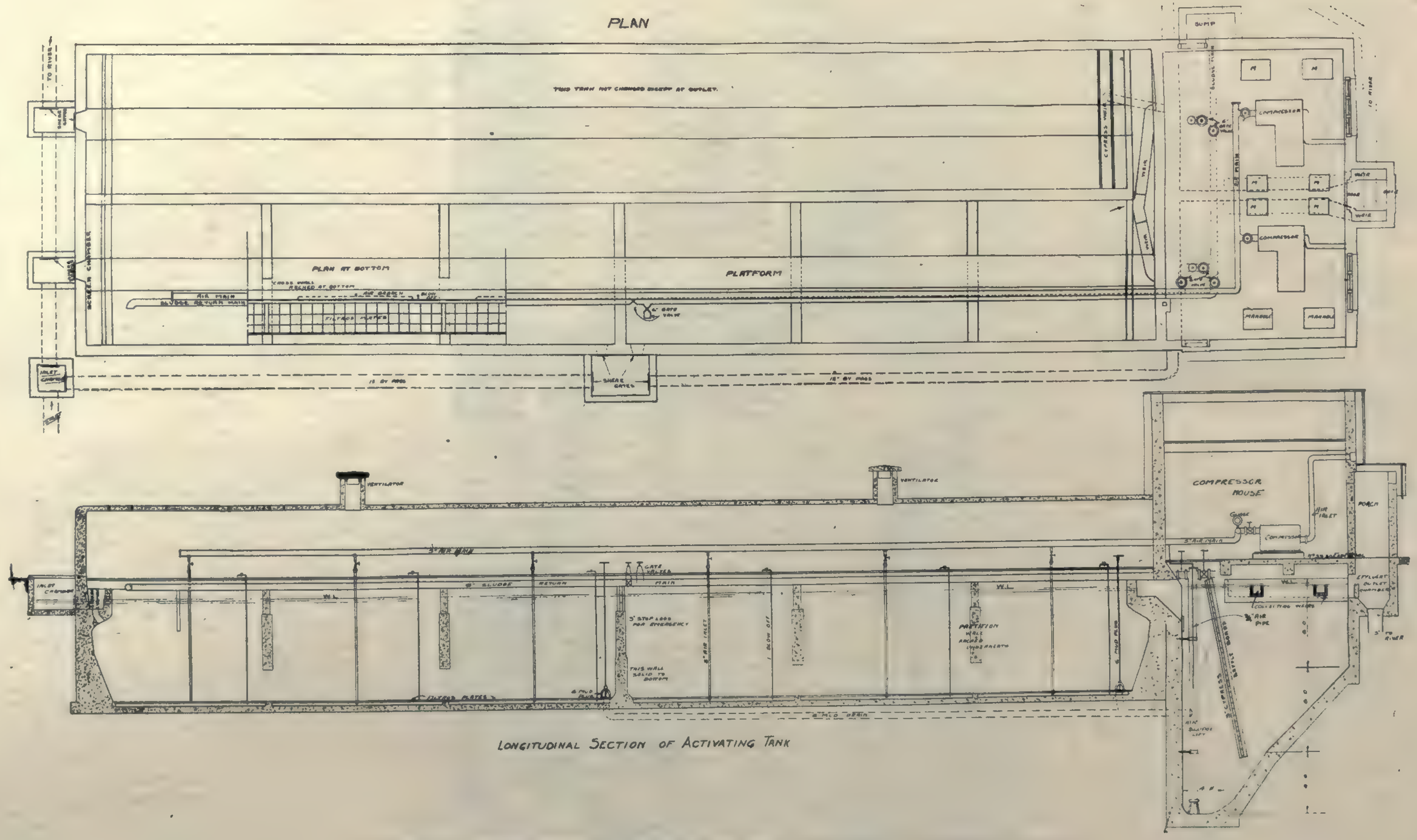
Upper left: A general view of the plant showing activating tank (with ventilators) and compressor house. Lower left; Special type of compressor with motor removed, indicating direct drive. Right: A view of the interior of the activating tank showing air line and sludge return line.

The compressor house was built of reinforced concrete with an ordinary wooden roof and asphalt shingles and the inside was trimmed up neatly.

Construction Amid Difficulties

Only about 280 yards of concrete were involved in the whole work but this was spread out in such difficult and unapproachable places that the work was very expensive. A good deal of dissatisfaction was expressed by the council at the amount of the estimates but these were later conceded to have been none too high even under the best of circumstances. The market for cast iron and wrought iron pipe at the time was demoralized by war production and much difficulty was encountered in getting prices on the material with a reasonable promise of delivery. The contract was awarded about September 18, 1918, and it was then hoped to have the work completed and the plant in operation by February 1, 1919.

On September 16, excavation was started for the new settling basin at the south end of the old tanks. A small stiff-leg derrick and hoist were used to handle the excavated earth and dump it into wagons. The derrick was placed at the south side of the excavation so that the boom would sweep over almost the whole area. It was afterwards used to erect the forms in panels and to place the concrete in the walls without moving either derrick or engine. The first ten feet of the excavation was through a clayey gravel overlying a peculiar quality of quicksandy clay which commenced a few inches above the level of the water in the river. A good deal of trouble was encountered owing to this fact as, during the fall rains, the river rose and seeped rapidly through the gravel into the excavation. Moreover, the clay contained so much quicksand that, on exposure to the dampness

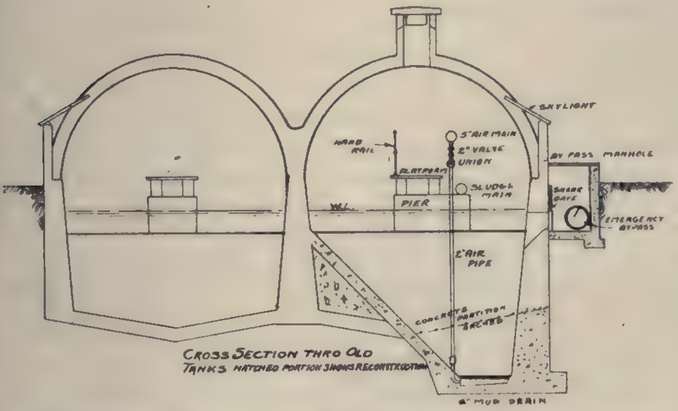


A plan and longitudinal section of the activating tank, settling tank and compressor house.

and the air for a few hours, it became as mobile as quicksand itself. The peculiar thing about it was that at first it was very hard and headway could only be made by blasting.

Tribulations of the Contractor

Light shots of 40% dynamite were placed at intervals of about 6 feet and about twenty shots were fired at once. This greatly encouraged the few men that were left working during the ravages of the "flu" and if a proper gang could have been secured, the 800 yards would very soon have been excavated. Several men were taken sick, however, and the wet weather, about the second week in October when the excavation was about two-thirds completed, made the hole a very nasty, dirty place to work.



One of a pair of septic tanks was reconstructed to make activating chamber.

Men, or such excuses as we were able to attract by the offer of high wages, would stay only a few hours and then chuck the job for something easier. Big wages were common in the munition plants at that time and work and money were easy to get. It was quite enough to make any contractor wish for the good old days when jobs were scarce and a fellow had to work to hold his job. If the foreigners were urged to do a little work, they immediately climbed the ladder and struck for higher wages. And the foreigners were not alone in the matter either. To make things worse our foreman was badly hurt by the crank of a gasoline engine and efforts to suitably replace him were fruitless. The writer, on several days went into the work with pick and shovel and, although I am not a heavy man, I may be forgiven for saying that I threw as much dirt as three of the others on the average. Men, in these days have gotten the upper hand and there never was a contractor in the old days who gave his men a more unfair deal than these same men would give their employers now. It is certainly no wonder that contractors have refused to accept any work whatever on a lump sum basis. I suppose, when these men have forced a slump they will have to come back to the old conditions of affairs and it will be their own fault.

The crib work in the bottom of the excavation was arranged so that the reinforcing could be placed around it and the concrete poured up to the shores which were then removed. The sloping wall on the south side, which was on a 1:1 slope, had to be cribbed as otherwise it would not stay up. A small gasoline mixer was operated at the west side and the concrete poured through a chute until the first fifteen feet of wall was placed. A 1:2:4 mix was used throughout, the crushed stone being supplied from Dundas by the Rogers Supply Co., Ltd., and the sand obtained locally.

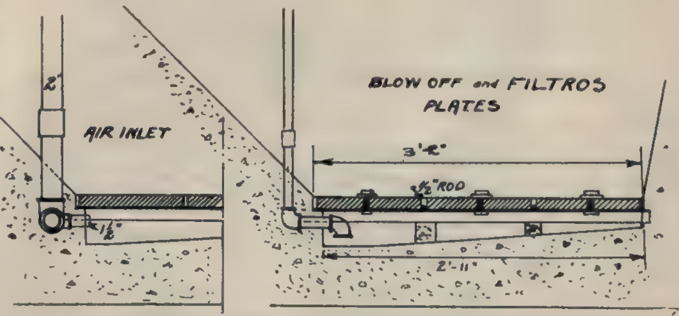
Labor Saved in Form Erection

The forms were made up in sections and designed so that the lower sections on being removed could be used to make the upper ones without knocking them to pieces. As the derrick was used in placing the sections, the 4 in. x 4 in. walings were nailed on the back of the ribs before lowering the sections into place. In this way much of the carpenter work was done by the time the excavation was finished and the forms were placed in a minimum of time. Each one of these panels was designated and the proper bevels determined before a board was cut with the result that almost no cutting had to be done in placing them. Forms for one 10 ft. section were placed, braced and completed ready for concrete in one day with the help of three carpenters and three laborers. This, of course, could not have been done but for the fact that all the lifting was done by the derrick.

The reinforcing was placed and wired securely in position before placing the forms. It happened that just at the time when the last section of wall in the settling tank was being prepared for the forms, the Pease foundry closed down for three days for repairs. We secured a few extra carpenters and built the forms for the compressor house, floor, and beams on sheds, and as soon as the outflow weir and wall section was completed we hitched the derrick to the beam and floor forms and lifted them into position as a unit, afterwards removing the skids. This saved us about three days that would otherwise have been spent in making up the forms for the floor. The forms for the compressor house walls were similarly placed in sections and a runway built on top of them.

Concrete Buggies Hoisted by Derrick

The concrete was dumped into the buggies and these were hoisted on the runway and dumped into the forms. A bridle was made from a logging chain with three hooks which fastened on the sides of the buggy and attached to the snatch block on the derrick line. This saved building any sort of elevator and proved a fairly speedy and inexpensive way of placing the concrete at a height not above 10 ft. from the ground as only one extra man was required to fill the buggies and attach the snatch block to them.



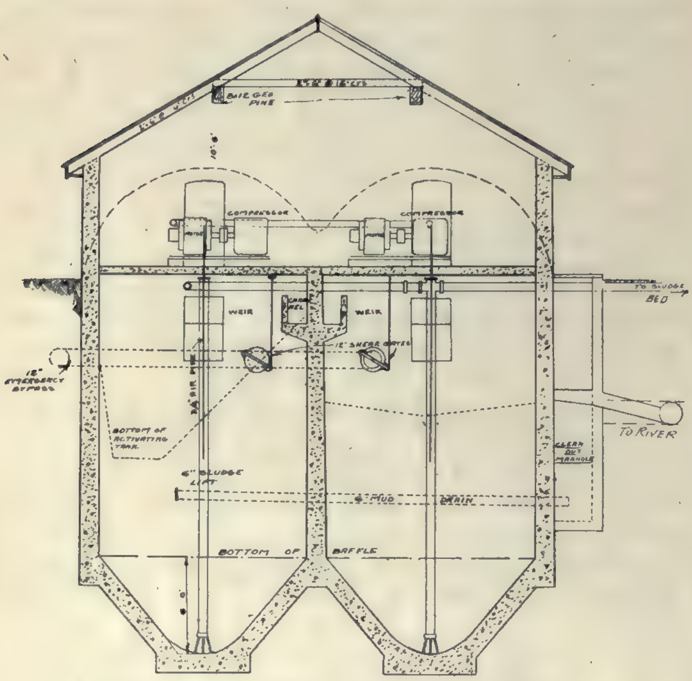
Detail of the filtros plates, blow off and air inlet.

Excavation of Activating Tank

By this time the weather was extremely cold and the concrete work on the compressor house was finished none too soon. Excavation was now commenced on the activating tank. The derrick was placed half way between the first two manholes on the side of the old tank and arranged so that the buckets could be lowered or raised into either manhole. In this way it was necessary to move the derrick only once during the work.

The excavation was carried out in 16 ft. sections, one section being concreted while the other was being excavated. On account of the time of the year a good deal of water seeped into the excavation and a pulsometer had to be kept in operation all the time. The excavation at best was a slow and difficult job as the clay was very hard, quarters were cramped and it was thought unsafe to use dynamite. The sand and stone for the concrete had to be heated and this necessitated using the boiler of the hoist engine to its capacity all the time, as it had to operate the pulsometer, hoist and heating plant at the same time and also, at times, it had to heat water for mixing operations. Here we suffered for lack of a little care at the start as we discovered that we had leaky tubes in the boiler and were forced to shut down and repair them with the weather below zero.

The underpinning was finally completed about the middle of January 1919 and the by-pass sewer was then laid and manholes completed as well as an outfall sewer to carry off the effluent from the settling tank. By February 15th the filtros plates had been laid, the skylights finished and glazed, the air lines and sludge return line completed and the shear gates and mud plugs installed.



Section of the settling tank and compressor house.

The work was considerably delayed at this juncture by a thaw when the river rose and flooded the works, necessitating a good deal of pumping before the work could be finished. With the exception of the installation of the compressor, however, the contract was completed by March 10th, 1919.

Ordinary Compressor Unsuitable

It was decided by Mr. Treadgold, after consultation with Milwaukee and Cleveland engineers, that the ordinary type of compressor was unsuitable for the job. The main reason was that a good deal of oil passed into the air lines and this, with fine particles of dust, plugged the filtros plates. A compressor of the centrifugal type was therefore purchased and installed with direct connection to the motor. This compressor is shown in an accompanying picture. It was, however, nearly the first of June 1919 before the plant was ready for operation.

The plant is now being operated about 15 hours per day. One man only is retained to look after it and his job is not a very onerous one. The sludge is aerated for a period of about 15 or 16 hours during the night and then the raw sewage flowing into one end of the activating tank forces the treated sludge into the settling tank where it settles to the bottom and at commencement of operations that evening it is either partially or wholly returned into the aerating chamber to start the action on the raw sewage which has come in during the day.

A rather peculiar circumstance was the occasion of much bother at first in the operation of the compressor. The water supply of the town is pumped from a lake to the north end and is very hard. It was found that on running the compressor for a short time it began to heat up and the reason was discovered to be that the lime from that water had clogged the valves leading to the water jacket and prevented the cooling of the compressor. The compressor had to be shut down and the water jacket and pipes cleaned out and this, of course, was certainly an unwelcome job. This, however, is only a minor detail and at worst will be completely overcome when the town installs a filtration plant as they intend doing in the near future. The trouble has been temporarily alleviated by putting in a trap which takes a good deal of the lime from the water before it reaches the cooling jacket. It is expected that a couple of small rain water tanks will be built in the near future, and by running the overflow back into the tank, which should be an easy matter with compressed air at hand, the lime in the water will be entirely eliminated.

No Sludge Problem

The system has now had a fair chance to be thoroughly tested out and as far as can be determined it promises to solve the sewage problem for the town for a long time to come. Certainly the results now obtained are above reproach and the Provincial Board of Health are satisfied as well as the obstreperous farmers owning land on the river bank. The upkeep is small, one man only being required for its operation, this in addition to the power used being practically the only item of expense. Of course, the amount of sludge treated is relatively small to what has to be treated in a large city, so small in fact that the problem of drying and getting rid of the sludge is negligible. This seems to be the principal objection to the system in larger cities, but in Brampton, the sludge is pumped into a drying bed and allowed to collect, being carted away at intervals. Its value for fertilizer or other commercial purposes has yet to be determined but little doubt seems to exist that they will be at least able to get rid of it without expense.

Compared with other systems there can scarcely be any doubt but that the upkeep is more expensive than in the case of sprinkling gravity filters. The fact, however, that there is not sufficient fall existent to operate a sprinkling filter system without expensive pumping equipment would seem to outweigh the former consideration. It would seem, then, that where sufficient fall exists to warrant the installation of gravity filters, it would be injudicious, at the present time at least, to use the aerated sludge system, at any rate in the form that has been described. However, a good many cases exist such as the town of Brampton where this fall is not obtainable and rather than resort to pumping, it is cheaper and better to aerate the sludge and dispose of it in that way.

In conclusion, the writer would have it especially noted that Mr. Treadgold and Brampton have been the pioneers of the activated sludge system in Ontario and probably in Canada. Beside Mr. Treadgold, who was the initiator of the scheme, should be mentioned Mayor L. J. C. Bull and Councillors Wm. Warr and the late Jas. Heatly who was inspector in charge of construction.

It is to be hoped that other municipalities will at least profit by Brampton's experiences in their anticipated work if they do not find it within their judgment to follow in the blazed trail.

Toronto Building Trades Council Propose Cheap Houses

REALIZING the critical nature of the housing situation, the executive of the Building Trades Council of Toronto have put forward a proposal for the construction of houses for working men at lower costs than have obtained in connection with other schemes. Briefly, the proposal is that the Building Trades Council use their authority to procure the adequate supply of labor to undertake the construction of 100 houses, provided the city will undertake to finance and provide the materials for the project. They claim that dwellings which now cost $4,000 may be built for $3,200, one source of saving being in the cost of supervising and designing. The executive officials of the council claim to have been offered the voluntary services of a firm of architects for $2,500. The profits on labor and material will be saved and a constant supply of workmen will be guaranteed.

In return, the Building Trades Council expects that the city will use its influence to prevent the erection of buildings whch might be termed luxurious.

The city architect, G. F. W. Price, in discussing the proposal, states that he is dubious concerning the amount of saving claimed by the Trades Council and he doubts whether they will be able to guarantee the supply of labor.

Monolithic Concrete Houses Need Not be Ugly*

A monolithic house of any architectural design, form or size can be built, but in order that the cost of construction be held within reasonable limits the forms must be used over and over again. This would require either that the same set of forms allow wire variation as to length, height and relation of surfaces or that the design itself be limited to the flexibility allowed by the particular system of forms employed. There is no system of concrete house molds available but that require a certain degree of standardization in design to make their use economical. Gables, bay-windows, curved surfaces or other than right angle corners add to the cost of form work.

For a large group of houses which is essentially the industrial housing problem today, much emphasis has been placed on appearance. Rows of houses of identical design are often condemned, and rightly so, if each individual house is ugly, whether built of wood, brick or concrete. There is little choice, however, between a group of houses all different but each of which is ugly and a group of ugly houses all alike excepting that the ensemble of all different ugly houses is more offensive than the group of all alike ugly houses. The real objection seems to lie in the design of the house itself. It does not appear that a group of houses each of which is pleasing will present an unpleasing ensemble even though all have the same general dimensions. Thus the problem is at once solved by producing a correct architectural design as to general style and proportions which can readily be altered in minor details such as, the entrance, porch and roof without at all affecting the pleasing architectural proportion. This is the work of the architect and offers a challenge to his talent and genius.

Design for a large project must above all other things be practical and must therefore meet all the real needs of the occupants. Large groups of industrial houses, will, in large measure, be occupied by a fairly uniform class of families. Different grades of workmen or different nationalities usually require separate groups with corresponding differences in size or design of house. Within each of these sub-groups there is little reason for much variation in the main dimensions or floor plans of the houses, and the objection of sameness can be at once removed by a skillful arrangement of houses with variations in roof and porches, surface treatment, location of entrances and the facing directions of their fronts. This has been amply demonstrated in a number of recent industrial housing developments and the fact that the monolithic house has practical limitations as to variety because of the use of forms should not hinder the adoption of this type.

The molds that have been developed and used may be classified as to material—wood and steel. The most widely known wooden concrete house molds are those invented by C. H. Ingersoll and used to construct the concrete houses at Phillipsburg and Union, N. J. These molds do not permit of much variation in design and a complete separate set is required for each type of house.

Another system of wooden forms utilizing grooved 2 by 4's which support and hold in place sectional wooden forms is known as the Felligren System, and we understand has been successfully used in and around Chicago,

Metal Types of Forms

The best known systems of steel molds are the Hydraulic Steelcraft, Morrill, Lambie, Metaform, Blaw-Knox, Schub and the Van Guilder. The Steelcraft, Morrill, Metaform, Blaw-Knox and Schub molds are made up of relatively small plates from 2 feet to 3 feet square. The Lambie forms are composed of steel channels set vertically, clipped together at the flanges and lined with horizontal liners composed of steel angles. The Van Guilder molds represent a different type consisting of a combination of plates about 9 to 18 inches high, held together by yokes and released from the wall by levers. When the chambers of the machine are tamped full or concrete, the plates are released and the machine moved ahead, traveling around the wall and forming a course from 9 to 18 inches high. This method produces a double wall and obviates the need of furring and does not impose restrictions on design.

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*From report on Monolithic Concrete Houses presented at National Conference on Concrete House Construction.

Fewer Design Units Mean Cheaper Construction

Cost of Reinforced Concrete Buildings Kept Down by Standardization—Supposed Economies Prove Expensive

ONE way of reducing the cost of engineering and of construction is by standardization. The standardizing of parts is being used in steel mill and factory structures, and it is evident that it can, to a certain extent, be applied also to reinforced concrete.

With this in view, the Special Committee on Standardization of Units of Design of the American Concrete Institute, A. B. MacMillan, chairman, made a study of reducing the number of units of the same class, thus to speed up construction. In a progress report to the Institute at last month's convention in Chicago, the committee presented some very interesting information to show the causes for excessive costs under which present construction is going on, and how standardization will reduce the cost of building. The salient features in the report are abstracted here.

Standardization of Steel Units

In the earlier days of structural steel each rolling mill had its own rolls, which varied in small details from those of every other mill and which covered an enormous gamut of sizes. Designing engineers, in striving for economy, as they thought, called for sizes varying by a few pounds weight for each slight variation of load to be carried, with the result:

1—That the engineering cost was more expensive than necessary.

2—That tonnage output of the rolling mill was reduced, owing to the innumerable changes in rolls required.

3—The work of the fabricating shop, together with the opportunity for error, was greatly increased owing to the possibility of mistaking one section for another which differed only in minor degree.

It was, of course, difficult to get material from several different mills and use it interchangeably, because of the lack of standardization. It soon became apparent that the multiplicity of shapes and weights put a tax on the use of structural steel that was unnecessary and undesirable.

As a result, the decision to roll only certain shapes and weights was reached, and designers were compelled to adopt these shapes and weights to their use. Needless to say, a good deal of agitation and misgiving was occasioned, but today we know that the change has been justified, that the smaller number of sections to be obtained are nevertheless sufficient for any case that may arise, and that economy has gone hand in hand with change.

The standardization of structural steel is but one example. This has been extended to steel sash and other items used in the construction of buildings.

Lack of Standard Units

The lack of standardization, with its attendant brothers, is clearly shown in the products of the various brickyards, hardly any two of which produce brick of a size and color so nearly alike as to enable them to be used interchangeably with the bricks from another yard. In a time like the present, where there is a decided shortage of brick, this condition is an unmitigated hardship.

Today we are facing an unprecedented demand for new buildings, on the one hand, and a shortage of materials and labor, a condition of congestion and embargoes on the railroads, and an unrest in the labor field that is reflected in a lessened output per man for the hours worked. It is, perhaps, due to the shorter hours that there seems also to be a falling off in efficiency over that which obtained before 1916. This can be accounted for, at least partially, if it is remembered that even before the war the workmen did not hit their full stride the moment the whistle blew, neither did they work at full speed to the moment of closing at noon or night.

Inefficiency of Labor

The condition of an early finish and a slow start obtains today, but owing to the shorter day now prevalent it means an actual decrease in the total output compared with the output of an equal number of hours for the longer day; although in each case, comparing hour for hour, the men may be working at exactly the same rate.

The reduction of output is greatly aggravated by the actual shortage of skilled and unskilled labor. This deficiency is estimated by the brick masons' union to be not less than ten thousand men for their trade alone. Such a lack of workmen, in the face of a tremendous demand for workmen, both by builders and manufacturers, has a tendency to increase the drift from job to job, with the resulting effect that new men must constantly be hired and educated for new duties. It is, or should be, quite apparent, that in a limited period of time it is much harder to teach a man how to perform a number of different tasks, and obtain satisfactory results each time, than it would be to teach one thing, and by constant repetition to reach a high standard of efficiency.

It is quite possible to take men of average intelligence and make them good workmen at any one job in a very short time, providing they are kept at one job without variation.

Reduction of Bar Sizes

At the present time the bar mills are being forced to reduce the number of sizes and kinds of bars rolled. This is largely an economic condition. The men in the rolling mills are paid on a tonnage basis; the overhead of the mill, too, is charged against the tonnage output. The mills, recognizing these facts, are today rolling approximately two-thirds of their output in sizes above the ¾ in. base size and one-third in sizes smaller than base.

To take a typical case, one ton of ⅜ in. round bars would equal 5,320 lineal feet, whereas it would equal but 1,350 feet of ¾ in. round bars. Unquestionably, the cost of labor and overhead on the larger size must be much less per ton than that of the smaller.

It is very probable that, for the immediate future at least, the intermediate 1/16 in. sizes will be abandoned and designers of concrete structures will be forced to content themselves with sizes that advance by even eighths.

Special Orders Increase Cost

Citing again the steel sash shops as an example of the tendency toward standardization, just so long as the regular stock sash with flat heads and horizontal pivoted ventilators are ordered, a reasonable time of delivery may be obtained. If, however, to satisfy a whim of the owner or engineer, vertically pivoted ventilators are called for, the whole operation of the shop is thrown out of gear.

The workmen in the sash mills are paid a regular rate plus a bonus for output. Just as long as the work is standard and regular the men earn a bonus worth while. Inject, however, something special, and the routine of the factory stops; the men do not make their bonus, with the result of a prompt disintegration of the morale and a great falling off of efficiency.

Examples may be multiplied, but this will suffice to indicate the desirability of standardization, not only in rolling mills and factories, but in the closely allied industry, the manufacture of buildings.

May Become Cheaper to Use More Materials and Less Labor

Constant thought and attention must be given to the relative cost of labor and materials.

In 1916, on an average job, a division of the money spent in producing the structure would indicate that labor cost about 30% and materials purchased about 70% of the total. Today the division would be approximately 40% for labor and 60% for materials, and it is predicted that in the near future, owing to the rising price of labor, this division may be more nearly fifty-fifty. As the labor cost increases it becomes self-evident that more and more material can be used, if thereby labor can be reduced.

To apply this line of reasoning directly to the individual parts of a concrete building is not simple. It is very difficult to make it clearly obvious that where a number of beams in a building are of one size, although the loading may vary sufficiently to allow decreasing the depth or the width in some instances, nevertheless such change, while it would undoubtedly save material, would probably make the saving at the expense of a considerable extra cost for labor and supervision.

It is proposed by the committee to submit at the next meeting of the American Concrete Institute actual design and estimating data illustrating the possibilities of a greater degree of unification, particularly relative to footings, columns and beams.

How Supposed Economies Increase Costs

In the meantime, a few specific instances of details that apparently economize but actually add to cost will be indicated.

1—Blueprints for a building recently submitted showed a total of 54 footings. These footings were in the form of truncated pyramids with a square or rectangular base. Slight variations in the size and shape of the base and of the top on which the column rested resulted in 19 separate types of footings. Of this number, 14 occurred once, 2 occurred twice, 1 three times, 1 occurred five times, 1 twelve, and 1 sixteen times. The footings as detailed doubtless saved some concrete over that required by simple steps, but the saving was made at the cost of some very fussy and expensive form work.

2—A second example is the case of a building with different story heights. While this may sometimes be necessary to tie into existing buildings, variations of this sort require piecing out or cutting off all supporting shores under the floor forms, as well as the column forms themselves, and is an added expense.

On another building of flat slab design, with circular interior columns, the column caps were called for 6 ft. 6 in. in diameter. The standard head made by the metal column mold companies is 6 ft. in diameter. This head was, therefore, a special piece of equipment and cost considerably more than the standard would. If the head had been made the standard 6 ft. diameter, and ½ in. extra concrete added to the depth of the plinth, the shearing value of the concrete would have been the same and the total volume of concrete used would have been no greater, and a saving would have been made in cost.

To touch on wall and interior columns in general, it is undoubtedly economical to keep the column size unchanged through at least two stories, varying the column mix and, if necessary, having some excess strength in the upper lift. This is particularly true where the columns are square or rectangular and wooden forms are used.

Expensive Exterior Column Design

Still another point in connection with wall columns in flat slab buildings may be illustrated. In the earlier days of flat slab construction the use of drop panels was largely confined to the interior columns, the wall beam was built usually entirely above the slab, and a simple haunch on the inside face of the wall column below the slab sufficed for all but extraordinary demands.

Today, designs frequently call for a plinth at the wall column as well as at the interior. As this plinth extends either side of the column, it necessitates a small drop beam, the depth of the plinth being carried across the head of the window, and in order to obtain sufficient strength it is also necessary to carry the beam above the slab. Probably it will not be disputed that this is more expensive than a simple beam above the slab, and usually performs no function which could not have been adequately arranged in a simpler way.

Another condition that occasionally arises is that where it is specified, gravel can be used for aggregate in the floors, beams, etc., but that broken stone must be used for aggregate in the columns. In many parts of the country gravel is the only easily available supply, or it can be purchased more economically than broken stone. Under these conditions gravel would naturally be desirable, but its use would mean getting aggregate from different stock piles and routing each batch of concrete on the floor so that no gravel concrete was placed in a column.

The roof of a building also requires careful attention. It is desirable that the regular floor forms be used with as little variation as possible. The story height should be the same as that of the floors below. The ceiling should remain flat, and it is a question if it is necessary to pitch the upper surface, provided a good job is made of the roofing.

Summary

Footings—Where the sides of footings are sloped the number of forms to be made should be reduced to a minimum by utilizing the same sloped form for footings even when the area of the base courses below the sloped portion are different sizes.

In many cases a stepped-up footing without steel will prove more economical than reinforced concrete footings. Care should be taken in the use of plain concrete not to exceed a reasonable unit in tension.

Columns—In order to effect economies in the form work it will often be found desirable to maintain the same cross section of column through several stories. In the case of interior columns where metal forms are used it is important that that portion of the metal form which adjoins the floor construction shall be uniform in the several stories to avoid the changing of the floor forms. When metal forms are used for interior columns, the reduction in the size of column, if made at all, should be made in every other story. The vertical steel reinforcement should be made up of as large bars as are consistent to good practice in order that the handling expense may be reduced to a minimum.

Beams and Girders—In determining the depth of beams and girders of floors, a careful study should be made to determine the depth which will give the minimum total cost for the reinforcing steel and concrete combined. This should be considered, although very often the minimum depth to be used for a certain span or the criterion of shear will govern the depth actually determined upon.

In general, the forms for roof construction should be the same as those for the floors, in order to avoid the expense of remaking the forms. It is very seldom possible to remake the forms and save enough concrete to make it worth while. Every effort should be made to so plan the construction that forms can be used from floor to floor.

Story Heights—From the standpoint of economy, it is desirable that the story heights be such that it will not be necessary to lengthen out the column forms to provide for the upper stories.

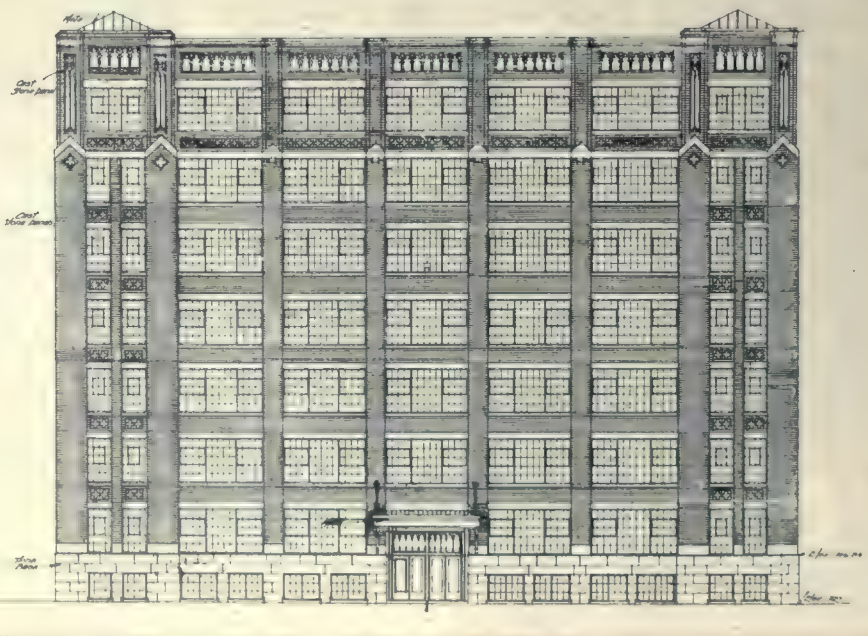
Steel Reinforcement—In order to avoid excess of labor costs in the field, it is desirable to reduce the number of lengths and sizes of reinforcing bars to a minimum, even if in so doing a slight excess in steel reinforcement is sometimes necessitated. In this connection, the number of bars used in any member should be reduced to a minimum, provided all the requirements for bond, etc., are taken care of. A minimum number of stirrups of maximum size should be provided to reduce labor cost.

Large Loft Building Being Erected in Toronto

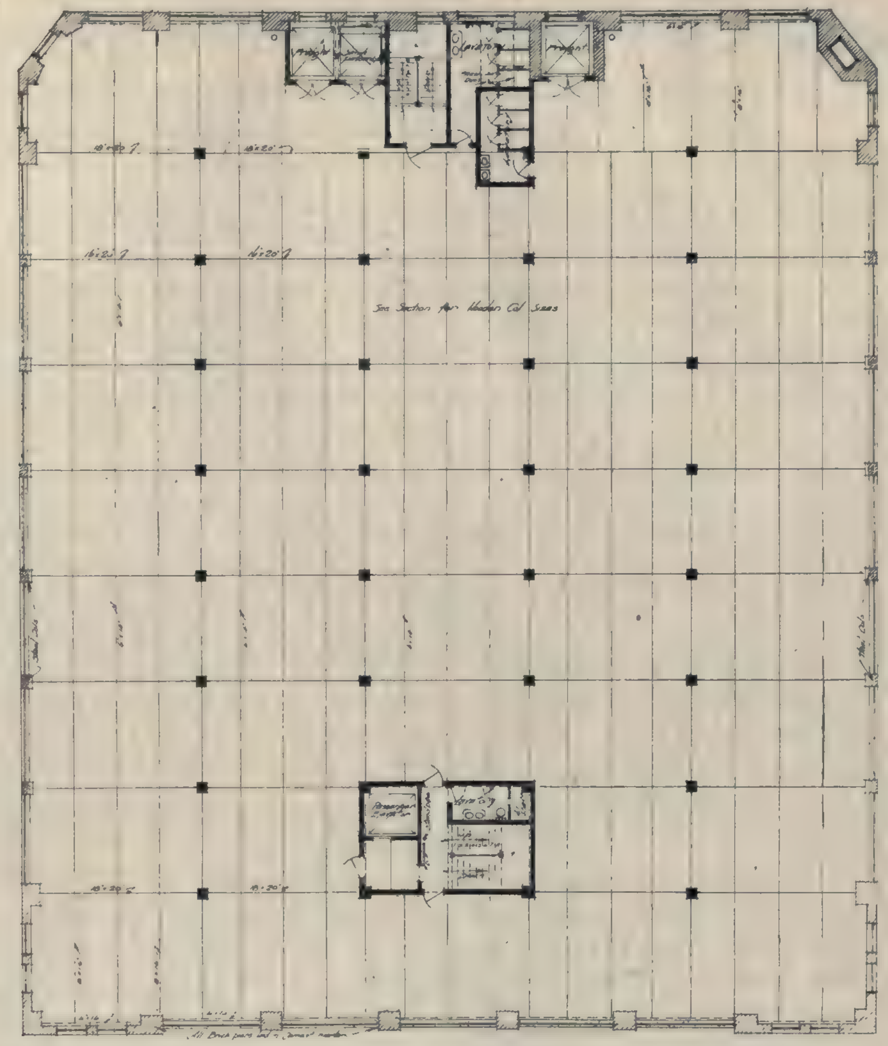
Seven Storey Mill Construction Warehouse Recently Started Will Have Maximum Glass Area on Four Sides

THERE is under course of construction in Toronto a loft building which is claimed to be one of the ten largest of its kind in Canada. It will be known as the Hobberlin Building, and was designed and is being erected by Yolles & Rotenberg, Ltd., Toronto. The outstanding feature of the design of the building is the fact that the absolute maximum of glass has been used on all four sides, so that the interior is unusually well lighted. As may be seen from the elevation and floor plan, the window area is very great in comparison with the total wall area, the piers having been kept down to a minimum size, consistent with strength. To assist in providing uninterrupted lighting, private lanes have been left on each side.

The building measures 120 ft. by 144 ft. in plan



In the design of the Hobberlin building, now in course of construction in Toronto, the lighting features have been primarily considered. On all four sides the maximum amount of glass area has been employed and lanes adjoining the building ensure uninterrupted light.



The Hobberlin building measures 120 x 144 ft. in plan and is seven storeys and basement high. The general type of construction is mill with steel columns on sides and brick bearing piers at front and rear. The column spacing has been made large to give open floor areas.

and is seven storeys high with basement. The general type of construction is mill, with heavy timber beam and column sections. The two side walls are skeleton steel construction, while the front and rear walls employ brick bearing piers.

The street elevation will be treated quite artistically from an architectural point of view, the design being a perpendicular Gothic.

The interior and side wall columns are carried on simple concrete pedestals, while rear and front wall loads are transmitted to reinforced concrete inverted continuous beam footings. The spacing of columns has been made large so as to provide the maximum open floor area. The floors are 3 in. tongue and groove, covered with a mastic flooring which is both sound proof and waterproof. A fast passenger and freight elevator service is to be provided.

Steel sash will be employed throughout and the clear glass will be protected by a water curtain. In addition, a sprinkler system will be installed.

New Montreal Sales Office

The Engineering & Machine Works of Canada, Limited, St. Catharines, Ont., owing to the rapidly increasing demand for their products consisting of boilers of all types, horizontal, vertical, locomotive and marine, tanks, plate work of all descriptions, etc., and particularly in connection with their recent and successful venture, the manufacture in Canada of the Keystone Light Traction Excavator, Motel 4, have found it necessary to open another eastern sales office in the Birks Bldg., Montreal, where inquiries can be more quickly and satisfactorily handled. This is in addition to their sales office in the Sun Life Bldg., Sherbrooke, Que.

Reorganization of Sarnia Bridge Co.

The Sarnia Bridge Company, Ltd., of Sarnia, Ont., has been reorganized under a Dominion charter which permits them to engage in many lines of trade formerly closed to them and opens a larger and more profitable field of operation. The rapidly increasing business of this firm has made this reorganization and expansion necessary. The company does not intend to enlarge its plant immediately, but plans and preparations are being made for the future. The officers of the reorganized company are: Mr. Roy M. Norton, president; H. B. Fenton, vice-president, and H. F. Howland, sec'y.-treas. The directors are, W. H. Kenny, H. W. Stewart, H. M. Pardee and F. J. Scupholm. Mr. Scupholm is in charge of the engineering staff and the other three directors are prominent Sarnia business men. The new company is capitalized at $500,000.

New Developments in Stucco Surfaces

Improvement in Appearance Obtained by Gradation of Aggregate — No Great Success in Coloring Through the Cement

STUDIES of the experimental stucco panels at the Bureau of Standards led to the general conclusion that by adherence to well established practice, structurally sound and durable stucco could be secured, but that a great deal could be, or ought to be, done to improve its appearance. Crazing and map cracking are common to most stuccos, and are especially objectionable on surfaces of fine texture; the monotony of the cold grey cement color is objectionable, and is only partially relieved by the use of white cement and mortar colors: and finally the muddy appearance (due to cement, or cement and pigment, being too much in evidence) is objectionable from an artistic standpoint.

Consideration of these matters suggested at once the use of less cement, and it became evident that by efforts in this direction improvement in appearance might be obtained. The apparently insurmountable obstacle to this departure from usual practice was, of course, the lack of plasticity in the leaner mixtures, various methods of overcoming this difficulty were considered, and some experiments were made which indicated that a real improvement might be obtained by substituting fine inert material for a portion of the cement. The easiest way to accomplish this result seemed to be by using blended cements, that is, normal cements ground with a certain percentage of sand, stone-screenings, or other suitable materials. These experiments were never carried very far, however, for it did not seem possible that any method which might be devised for retaining plasticity could bring about the desired result, viz., the elimination of all the objectionable features mentioned above.

Serious as was this lack of plasticity in the lean stucco mixtures, it was after all, something that could be overcome by work. This was demonstrated by the fact that mixtures as lean as one part cement to six parts of stone screenings were applied on some of the Bureau of Standards panels, with excellent results. But the improvement in these panels as compared with some of the easier working combinations did not seem great enough to justify the increased cost of application. The question finally arose whether by careful attention to gradation of the aggregates this improvement in appearance might not be so enhanced that the cost would be a secondary consideration.

Color Determined by Aggregate

This idea came from the fact that Mr, Earley had succeeded in making complicated casts of concrete from specially graded aggregates in such manner that a very large percentage of the area of the treated surface (first wire brushed and then washed) was aggregate, and a very small percentage cement. Possibly due in part to the higher reflecting power of the concrete surfaces of the exposed aggregates, the color of the concrete surfaces thus produced was determined almost wholly by the color of the aggregates, and only very slightly affected by the cement itself. A most convincing demonstration of this fact was obtained by constructing two concrete slabs containing exactly the same proportions of specially graded aggregate, the one being mixed with grey cement, the other with white cement. After the surface treatment of brushing and washing had been applied, only an expert could have determined which slab contained the grey cement and which the white.

To digress still further for a moment, this method of obtaining permanent and very pleasing colors in concrete surfaces is such an important item in the development of the processes here described, that it is worthy of fuller explanation. Before color in concrete surfaces can be under artistic control, a technique must be developed which has for its medium the elements of the concrete itself. Although in problems involving appearance aggregate is by reason of its greater bulk the major element, and cement the minor, it is, nevertheless the color of the cement which is the natural color of normal concrete. The reason for this is that the cement is finely ground and deposits itself, paint-like over the surfaces of the aggregates and colors the whole mass. If, therefore, concrete is to receive its color from the cement paste, variation must be obtained by the addition of pigments to the cement following the well established practice of mixing paints; but if the aggregate is to be the source of color, the concrete must be so designed and manipulated as to deposit in the greatest possible amount of aggregate.

No Success in Coloring Concrete Through the Cement

Any great dergee of success can hardly be expected in coloring concrete through the cement. The choice of colors is restricted by chemical reaction with the cement which causes them to fade or change; depth of color is restricted by strength requirements of the concrete which limits very closely the amount of pigment which may be added to the cement. Therefore with the choice of color limited by one requirement and the depth of color by another, the cement itself must remain dominant,

On the other hand, in coloring concrete through the aggregate all such restrictions are removed, and colors may be obtained from white to black, through all the range of possible aggregates. An examination of drawings done in hard pastelles and of paintings of the impressionist school suggests a technique in coloring which is peculiarly adaptable to the coloring of concrete by means of the aggregate. In the pastelles tones are produced by hatching and cross-hatching with lines of pure color without blending on the surface of the drawing, in the paintings by spotting with pure colors one beside the other and without blending. In both cases the tones are effected by the blending of the light rays reflected from the picture to the observer. Wonderful depth and clarity of tone are characteristics of the school of coloring, and in it are to be found a great deal of exact knowledge and valuable precedent. When this knowledge is translated in terms of concrete aggregates, it is obvious that if the aggregates are carefully selected and carefully placed, all the elements are present for the successful coloring of concrete surfaces. The results obtained in practice bear out the theory given above, and there is every reason to believe that the aggregate is the proper source of color for concrete.

Application to Stucco

Hence, it was a most important conception that a similar result might be obtained with stucco. The success of this depended, first, upon securing a suitable gradation of the stucco aggregate, and second, upon being able to apply such a mixture, once it were satisfactorily compounded. It was known at the outset that these mixtures would be harsh, therefore plasticity no longer played any part in the calculations.

The laboratory program was fairly simple. The plan consisted simply in working first with concrete mixes in miniature, in which the sizes of cement particles, sand particles and coarse aggregate particles were reduced from the normal sizes in the ratio of about 1:10, this being taken as the approximate ratio of the size of particles passing a No. 8 sieve to pebbles one inch in diameter. It was assumed that the density of such mixes would depend mainly on relative sizes of the component particles, with due allowance for the water content. If these mixes appeared to be satisfactory for the purpose, it was assumed that any reduction within the 1:10 ratio would also be satisfactory and the actual reduction to be employed in compounding any given stucco mixture of this type would be as slight as the requirements of texture and the difficulties of application would permit. To make a long story short these experiments in the laboratory with the miniature concretes were very successful. Not the least important part of the laboratory work was the miscroscopic examination of the structures of these little concretes, which yielded many valuable suggestions for the graduation in size of particles, and for the proper proportions of the various sizes, to yield the desired effects in the treated surfaces.

Success of the New Stucco

The first attempt to apply the new product to a vertical wall was not wholly discouraging. Small areas were treated successfully, and eventually a portion of one of the new laboratories of the Bureau of Standards was coated with the exposed aggregate stucco. This example while it is not as free from imperfections as the more recent work, has attracted most favorable notice. Fortunately, the mechanics who were selected for this work developed a real interest in the new type of finish, and subsequently a pride in the results of their work, which made for very rapid progress in the development of the methods of application and treatment, New requirements in thoroughness of mixing, consistency, and control of the absorption of the undercoats were met, and other improvements in the general process were gradually introduced as essential parts of the routine. Not all of the problems have been solved, but there has been very gratifying progress in the comparatively short time that the new stucco has been applied commercially.

The writers believe that the work here described shows progress in the development of concrete and stucco as materials worthy of a place in the highest type of buildings or structures. It is to be noted especially that none of this work is an imitation of stone. Casual inspection shows that it is concrete, with textures that vary widely, but always characteristic of concrete. Furthermore, the material may be cast in any form the architect may desire, with all details complete; no cutting, tooling or dressing is required other than the prescribed treatment of cleanly exposing the aggregate. Finally the material provides a medium for the expression of color in infinitely greater variety than that which obtains in the natural building stones.

Stucco is More Than a Plaster

In conclusion the writers would add a word about stucco. The new type of exposed aggregate finish cannot fail to arouse new interest in stucco, as a product, regardless of the nature and treatment of the finishing coat. The product should be more widely used, and, the reason it is not more widely used is that it has too often been applied by contractors or mechanics who consider it only as an outside plaster. This paper has attempted to convey the impression that cement stucco is more like concrete than plaster and that plasticity is not essential. The point the writers wish to emphasize is that the art of applying durable stucco is very different from the art of plastering, and in their opinion, stucco will take the place it deserves among building products only when this fact is generally recognized.

Ontario Architects Raising Fees

New Schedule of Minimum Charges Adopted by Ontario Association to Meet the Cost of Increased Service

THE Ontario Association of Architects decided to raise their scale of fees at a meeting of the council of the Association held in the Engineers' Club, 96 King street west, Mar. 22.

According to the new scale the minimum charge for services will henceforth be:

1. In the case of factories and large plain buildings involving no detailed interior finish, five per cent. of the total cost, in place of the former charge of four per cent.

2. In the case of public buildings, office buildings, warehouses, banks, and ordinary buildings, six per cent. in place of five.

3. In the case of residences, from eight to ten per cent., according to the amount of special detail work required, in place of the former charge of from seven to ten per cent.

The total cost of the building is now interpreted to be the cost to the owner of the completed building, including any material or labor that may be supplied by the owner apart from the contracts.

The only other important alteration in the basis of charges is that whereby charges are to be increased to cover the cost of the services of a specialist when required in the case of heating, ventilating, mechanical, electrical and sanitary problems of a special nature.

To the Contract Record, Mr. Geo. West, treasurer of the Association, stated that this new schedule is not inaugurated on account of the increase in the cost of living as that is taken care of by the increase in the cost of construction which, of course, augments the amount of the fee to the architect. The revision in charges is due rather, according to Mr. West, to the greater service that an architect is being called upon and expected to give at the present time in the design and construction of buildings.

Grouting Pressure Tunnels of Catskill Water Supply System

Methods, Developed on Unusual Scale, for Making Aqueduct Secure and Tight Against all Leakage by Means of Grout

THE utilization of the pressure-tunnel type is one of the notable features of the Catskill Aqueduct. There are nine pressure tunnels, aggregating 35 miles in length. These tunnels were driven in rock, deep beneath the surface, and were lined with concrete averaging from 18 to 24 in. and more in thickness. They have a finished inside diameter varying from 16 ft. 7 in. to a minimum of 11 ft. The depths of the tunnels below the surface vary from 100 ft. to a maximum of more than 1,100 ft., the latter being the depth of the Hudson River crossing. The hydraulic gradient at this crossing is more than 1,500 ft. above the invert of the tunnel.

It was the opinion of some authorities that the concrete lining could not be made tight enough against ground-water heads. It was also feared that where the rock was porous and water-bearing, excessive leakage might develop when the tunnel was put in service, and that the application of pressure in the case of jointed and fissured rocks might even cause movement of the rock and rupture of the concrete lining, with resultant outward leakage. Great reliance, therefore, was placed on the use of grout to make the tunnels secure and tight against all leakage. The experiences and results obtained in this grouting are summarized by James F. Sanborn and M. E. Zipser in a paper presented before the American Society of Civil Engineers. The matter following is abstracted from the paper:

Grouting in pressure tunnels was done in two stages: (1) Low-pressure and, (2), high-pressure grouting. The purpose of the low-pressure grouting was: (a) primarily to fill the void spaces between the lining and the rock, particularly above the arch, and, at the same time, to form a blanket over the construction joints in the arch; (b) to fill the voids in the dry packing where the latter was used; and (c) to fill any porous or honeycombed spots in the the concrete.

The object of the high-pressure grouting was: (a) To cut off the leakage of water into the tunnel and thereby prevent the escape of water out of the tunnel by filling with grout, forced in under high pressure, the crevices and openings in the surrounding rock; and (b) to complete the filling of the voids between the lining and the rock, particularly in the high places in the roof, and between the drip-pans and the rock. In general, the procedure followed in grouting was first to grout the space above the arch under low pressure through the pipes set for the purpose, and then to grout, under high pressure, the vent pipes and weepers.

Details of Low-pressure Grouting

The details of the low-pressure grouting differed somewhat on the various contracts, the following description being typical of the procedure as finally developed. When a stretch of tunnel was ready for grouting, the usual practice was first to grout the arch pipes, beginning at one end of the stretch and working toward the other. The pipe to be grouted was first raked out in order to clean it of any obstruction; sometimes, it was blown out with air to clear it. Plug cocks were placed on all pipes to which connections were made. A 2-in. grout-hose connection, equipped with a side vent, was attached to the pipe to be grouted, and batches of grout from a tank grouting machine were then discharged through the hose and into the pipe, by compressed air. The pressure ordinarily used for this grouting was about 75 to 90 lb. per square inch.

Grouting was continued at each pipe to which connection was made until the pipe refused to take more grout or until the grout had traveled along the roof several hundred feet ahead, when connection was made with another pipe and the process repeated. The distance which the grout above the arch could be forced ahead of the pipe, varied from 200 to 300 ft., and, in some cases, where there was a large continuous void space in the roof, it would travel more than 500 ft. It was the usual practice, however, where conditions were normal, to grout the space above the arch by making connections to the roof pipes 125 to 200 ft.

In charging the grout tank the cement, sand, and water in proper proportions were placed in the tank, and the air was allowed to boil up through the batch to agitate it, while, at the same time, the batch was generally stirred by a hand paddle, as the air alone was insufficient to mix the materials thoroughly.

As the batches of grout were forced into the pipe and the grout flowed ahead, water in large streams issued from the adjacent roof pipes; this was the excess water from the grout, as well as the ground-water leakage which had collected above the arch. This water was pushed ahead of the grout, and as soon as the pipes showed a flow of grout they were plugged either by driving tapering pine plugs into them or, as in the case of the vent or other pipes to which connection was to be made for high-pressure grouting, they were closed by means of the plug cocks at the ends. In some cases, the holes for the connections were plugged by driving a wad of oakum back into the far end of the pipe. At the end of the shift, or several hours after grouting, when the grout had partly set, the oakum was removed with an auger. Any pipe which had filled up with grout that had set, was drilled out for the subsequent grouting.

Stopping Leakage

During low-pressure grouting, the high vent pipes were kept open to drain off the excess water, to permit the escape of air, and to prevent the accumulation of ground-water pressure. During the grouting, the transverse joints in the arch and any porous spots in the concrete generally showed a seepage of water first, then very thin grout appeared, after which, the leaks usually stopped in a short time, and silted up. In some cases, the leakage of grout and water through the joints was stopped by driving thin wooden wedges into the joints, and leakage through the porous concrete was stopped by bracing and wedging a board covered with a mat of oakum against the porous spot. The longitudinal joints on either side of the key at the top of the arch also leaked in a few stretches, due principally to porous concrete in the vicinity of the joints.

The weepers from drains and drip-pans, and the deep-seated pipes were also kept open during low-pressure grouting. The matter of proper grouting is of the greatest importance in securing good results, because it is essential not to permit the building up of a ground-water head on the fresh grout since the object is to form an impervious blanket over the top of the arch and thereby prevent leakage of water through the unset grout and the formation of channels through the transverse and longitudinal construction joints or through any porous spots in the concrete.

Proportions Used for Low-pressure Grouting

A batch of grout consisted of 1 bag of cement weighing about 95 lb., 1 bag of sand weighing generally about 80 to 90 lb., and from 6 to 8 gal. of water, the total making a batch of about 2.0 to 2.2 cu. ft. of liquid grout measured in the tank. The sand was very fine, screened when necessary to meet the requirements of the specifications, namely, that 100 per cent. pass a sieve having 64 openings per square inch, 45 per cent. pass a sieve having 1,600 openings per square inch, the wires of the sieves being, respectively, 0.035 and 0.013 in. in diameter.

Progress in Low-pressure Grouting

The progress in low-pressure grouting varied, usually from about 600 to 1,000 ft. of tunnel a week, working three shifts a day. Many factors influenced the speed, such as the length of haul, the delivery of materials, the proficiency of the gang in loading and unloading the cars, etc., and, of course, the volume of space to be filled above the arch. Usually, in normal stretches of tunnel, not more than one or two connections were made in 24 hours. The sand and cement were hauled through the tunnel to the grouting plant on flat cars holding from 20 to 30 bags. The sand was brought to the work in bulk, but was bagged by hand at the top of the shaft before it was sent underground. Tests were made of handling the sand in bulk in the tunnel, but it was soon found that a package of about the same size and weight as a bag of cement was the most convenient form for rapid handling.

The force employed in the tunnel for low-pressure grouting was generally one foreman and seven or eight men, two charging the grout tanks, one stirring the batch, one operating the valves on the grout tank, and three or four handling the hose and making the connections. On the surface, men were employed to bag the sand and load the cars on to the cages.

Precautions to be Observed in Placing Low-Pressure Grout

Low-pressure grout should be injected gently under as low a pressure as possible to avoid churning of the mix and separation of the ingredients, and only a sufficient quantity of water should be used to produce a freely flowing mixture that will not clog the hose. The air pressure should not be higher than necessary to force the grout through the hose and into place. A reducing valve was used on some parts of the work to cut down the line pressure from 90 to 40 and 30 lb. per square inch. An excess of air, especially when injecting grout under water, is likely to agitate and churn the mix, causing separation and stratification of the sand and cement, with the formation of a soft deposit of laitance at the top of the grout in contact with the rock.

To avoid the after blast of air when grouting a space filled with water, it was the usual practice to close the discharge valve before the hose "kicked," the latter requiring careful watching. A further precaution used to prevent the separation of the mix where a large space filled with water was grouted, was to keep the grouting connection from 2 to 3 ft. below the top of the grout.

The importance of venting the high pipes and allowing all the weepers to run freely during low-pressure grouting has been referred to. It sometimes happens that low-pressure grout enters the drip-pans or drains, but in such cases the pipes should not be kept closed to allow the accumulation of ground-water pressures.

Details of High-Pressure Grouting

It was the general practice first to grout the high vent pipes in the roof, in order to complete the filling of the space above the arch, and then to grout the pipes from the drip-pans and the deep-seated pipes leading to the rock seams. Some of the vent pipes in the roof showed a flow of water in stretches originally dry. The grouting of one vent pipe would often stop the flow of water from another, indicating a flow of grout through the open seams in the rock. In other cases there would be an increase in the flow of water from a weeper due to forcing water through the rock seams to an open vent. As a rule, very little grout could be injected into the vent pipes.

After grouting the arch pipes, the "wet" pipes, or weepers, were next grouted. In starting operations, air at 100-lb. pressure was blown into the pipe to expel the water from the drip-pans or seams. This was sometimes followed by a charge of water to clear the pipe just prior to grouting. The charge of water was often applied as a test to give an idea of the circulation of grout to be expected. If the charge of water failed to "go," the pipe would take very little grout. Another indication of the size and extent of the rock seams that could be reached from a connection was the showing of air at another open pipe or the refusal of the pipe to take air when high pressure was applied.

The usual practice was to grout the weepers with a mix of 1 bag of cement and 5 to 8 gal. of water. When the pipe would take no more grout, the high pressure, about 300 lb. per square inch, was kept on it for from 5 to 10 minutes, which had the effect of squeezing the water out of the grout and packing the cement solidly in the pipe. Frequently, if this procedure did not completely fill the pipe, it was drained and plugged with a thick batch of grout. Temporary plugging of a seam during grouting was often overcome by forcing air into the seam under high pressure.

It was found difficult to shut off small leaks through pipes set in the lower portion of the side-walls where no vents were provided. After a pressure of 300 lb. per square inch had been maintained on these holes for several minutes, it was often found that no grout had been forced in the pipe and the leak still continued. Such pipes were successfully closed, even in the case of those which flowed several gallons per minute, by driving a tight-fitting wooden plug into the extreme end of the pipe and then ramming with dry cement.

It was the practice on some parts of the work to complete the high-pressure grouting on all the key pipes in the arch in a stretch of tunnel, after which the tunnel was gone over a third time when the flowing pipes were grouted.

The pressure used for high-pressure grouting varied, as a rule, between 250 and 350 lb. per square inch. This was the pressure at the grouting tank. It had to be sufficiently high to overcome the ground-water pressure and, in addition, to force the grout into the seams in the surrounding rock. In the case of very fine seams, the frictional resistance is so great that it is doubtful if much grout is injected into them even under high tank pressure.

Mix and Consistency

To insure the flow of grout into the fine openings, neat cement was used in high-pressure grouting. The consistency of the mix varied, depending on the conditions. Ordinarily, 1 bag of cement and 5 to 8 gal. of water were used. Where grout could be forced into the rock seams it was mixed very thin—as thin as ¼ bag of cent to 30 gal. of water. If this mix was taken freely, it was was regarded as an indication that the grout was travelling some distance from the tunnel lining and, therefore, was not of much value. The mix was accordingly thickened gradually by increasing the quantity of cement in the batches until the pipe began to refuse grout, when thin grout was again injected, the pipe being finally plugged with a batch of thick grout under 300-lb. pressure.

It was originally contemplated to use very finely ground cement for grouting in order that the grout might be carried readily into the finest seams. However, cement of ordinary fineness of grinding was used, as it was realized that, in time, the openings outside the tunnel lining and through the body of the concrete would silt up. Experiments show that the finer the grinding, the greater the loss in the strength of the grout on account of the more thorough hydration of the cement. The coarse particles impart strength to the cement, and, for that reason, very fine grinding may not be desirable.

A very important factor in successful grouting is the control of the consistency of the mix. For large openings, thick consistencies should be used, while for the very finest openings the best results are obtained with thin grout. The thick mixes, however, must carry enough water to prevent undue clogging. No coarse particle or lumps of cement must be allowed to go into the tank. The cement is sometimes affected by the dampness of the tunnels and should be screened when necessary. Grouting of a hole must be continued without an interruption long enough to clog the hose or permit an initial set of the grout.

Equipment Used in Grouting

Tank grouting machines of the Canniff type were used almost exclusively for grouting. These machines are very simple in construction and operation, consisting essentially of a tight cylinder provided with suitable pipe connections for introducing compressed air and for mixing and ejecting the grout. The tanks are very compact, weigh about 500 lb. when empty, and have no moving parts to wear out and be replaced. They are, therefore, particularly well suited for tunnel work. Both thick and thin mixtures can be used in them, and they are equally well adapted for high and low-pressure work. They are very efficient where large quantities of grout have to be placed.

As a rule, two grouting tanks were operated simultaneously in grouting the tunnel, one being charged while the other was discharging. For high pressure work, however, it was the usual practice to use only one tank. The two tanks were mounted either alone on a low flat car, or at one end of a platform car which was large enough to hold, in addition, from 20 to 30 bags of sand and cement. In some cases, an upper platform was also provided for materials. The materials were hauled through the tunnel by mules or motor trucks. The water for mixing was measured either by pails, or automatically by a tank placed at the side or above the grout tanks. High-pressure armored hose about 25 ft. long was used for grouting purposes.

Operation of Grout Tanks

The usual method of operation during low-pressure grouting, was first to put into the tank the required quantity of water, then to let the air into the tank at the bottom, which agitated the water, and then the cement and sand were put into the tank and stirred by hand with a wooden paddle, as it was found that the air was too slow for mixing and was also wasteful. When thoroughly mixed, tthe door at the top of the tank was closed, the air was then admitted at the top, and the liquid grout forced out through the grout hose into the pipe connected to it. The air was then turned off quickly.

Unless care is taken to close the air discharge valve the instant the last of the grout leaves the tank, an after-blast of air follows the grout, resulting in stirring it up and causing separation of the materials, and also tending to form air pockets in the space grouted. The men operating the tanks, however, soon become skilled in controlling the discharge. As an added precaution, the air-pressure gauge on the grout tank was watched closely to note the fall of pressure as the grout discharged, and the emptying of the tank was also indicated by the "kick" of the grout hose when the charge left it.

In some cases the following scheme was tried. The air valve was closed as the batch of grout started to leave the tank, permitting the air in the tank to expand and force the grout through the hose. This method, however, was slow and was not generally used. Where the grout displaced water, the ejection of the grout by expanding the air in the tank was quite effective in cutting down the after-blast of air. The tanks could be operated very rapidly. As much as 1,500 batches of 1:1 grout, equivalent to about 115 cu. yd., were placed in 24 hours, using two tanks. This process involved the handling of about 135 tons of cement and sand in the 24 hours.

Air Compressors

The air for operating the grout tanks was obtained by connecting to the air line laid in the tunnel, the air pressure in the line being usually from 80 to 100 lb. In order to provide the pressure required for high-pressure grouting, small Westinghouse direct-acting single-stage air compressors, known as "boosters," were generally used. These compressors, mounted on the same car with the grout tanks, took suction from the main air line and delivered air in the tanks at a pressure of 300 lb. per square inch.

On the work in the northern portion of the City

Tunnel, low-pressure grouting was carried on with three rigs, each consisting of the following equipment: One 30-h.p. electric motor; one Ingersoll-Rand 2-stage, belt-driven air compressor, capable of delivering 170 cu. ft. of free air per minute at 100 lb. pressure and 130 cu. ft. at 350 lb.; one geared pump, with a capacity of 50 gal. per minute driven by a 7½-h.p. electric motor; two grout tanks, two water tanks, a platform car for making connections to the grout pipes, and a platform mounted on two flat cars for the cement and sand. For high-pressure grouting the same rig was used, the compressor being adjusted to deliver air at 300 lb. per square inch.

In the Hudson Tunnel, where it was necessary to use grouting pressures of 700 lb. per square inch, a combination of air and water-pressure pump was devised. A Canniff tank was partly filled with grout which was placed under a pressure of about 300 lb. by a Westinghouse booster connected as usual with the tank. Water was then pumped into the tank through another connection by a high-pressure Cameron pump, reducing the volume of air above the grout so as to raise the pressure to 700 lb. per square inch, if desired. The discharge valve of the tank was then opened, and the pump was kept going in order to mainain the pressure while the grout flowed slowly into the space back of lining. This arrangement worked very successfully. The advantage of a pump with a steady flow lies in the fact that there is no after-blast of air forced through the grout.

Building Permits in New Westminster

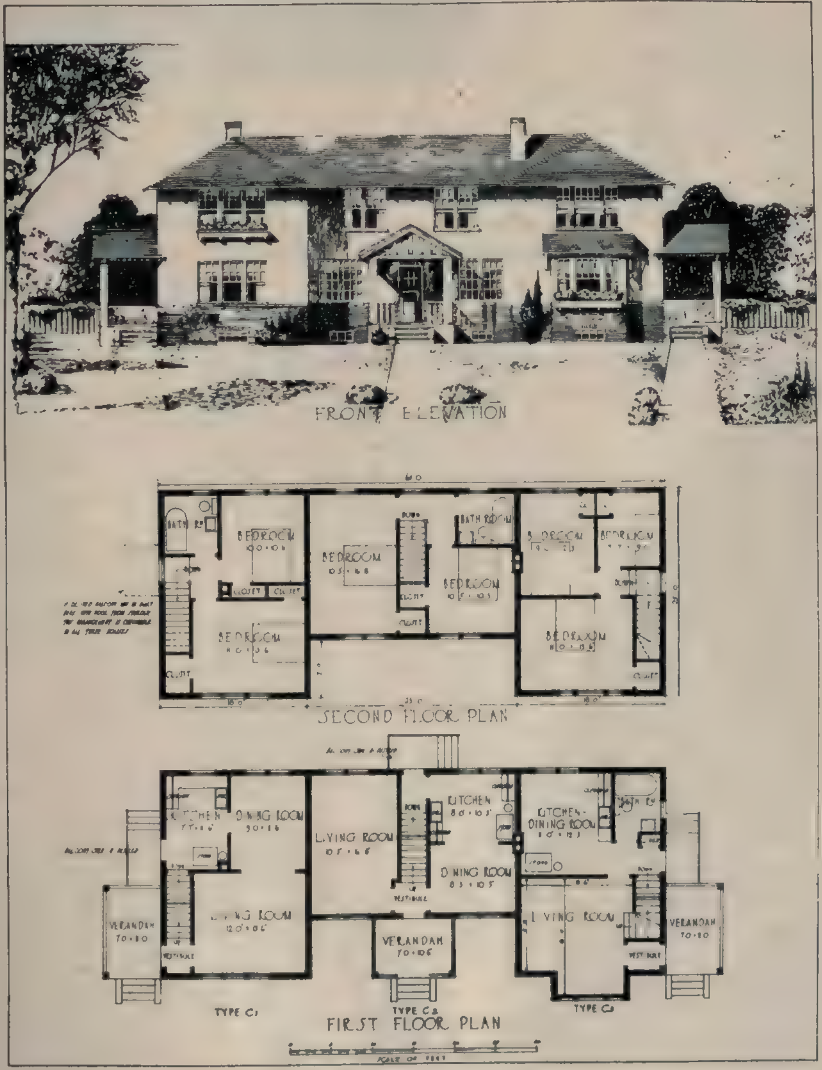
In New Westminster, B. C., the following were the values of building permits for the periods indicated:

Building permits for February 1920	$95,215.
Building permits for February 1919	$17,075.
Building permits for two months 1920	$105,165.
Building permits for two months 1919	$22,575.

New Building Repair Firm

Messrs. Robt. G. Ross and W. F. Smith announce that they have entered into partnership under the name of Ross and Smith with office and yard at 66 John Street, Toronto. The new firm will conduct a business of building alterations and repairs in all trades.

A Suggested Plan for a Group of Three Houses



The elevation and floor plans shown in the accompanying illustration were developed by the Dominion Housing and Town Planning Adviser. They are a suggestion for a group of three houses. By following the arrangement indicated an unusually pleasing effect is obtained. This is partly due to the set-back given to the centre house and to the side entrances on the end houses. From the floor plans it will be noticed that the rooms are arraned in a manner that eliminates waste space, at the same time fulfilling every requirement of the small house.

No. 12

Canada's Contractors—J. J. Manley

Some of the largest pieces of construction carried out in Canada are marine developments such as harbor and dock works. With the large amount of navigable waterways that this country fortunately possesses, it is evident that projects of this character must necessarily occupy an important place. Some of our best known contractors have been connected with harbor and dock undertakings and we can safely say that to them we may attribute, in great measure, our state of progress and development. One of the old hands in the marine contracting business is Mr. John J. Manley, vice-president and superintendent of the C. S. Boone Dredging and Constructing Co., Ltd., Toronto. Mr. Manley can date his experience back to 45 years ago, when he began his dredge career as a wood boy on the Welland Canal, under the famous James Canan. It will thus be seen that he started at the bottom of the ladder and his present position has been attained only after hard work through all stages of the dredging game. Mr. Manley has been continuously engaged in extensive harbor work and has been responsible for dredging and steam shovel contracts on all of the Great Lakes. He has worked on almost every harbor and canal from Quebec to Chicago and on the Georgian Bay and Lake Superior as far west as Port Arthur and Fort William. For a number of years he was with Larkin and Connolly, of Quebec, and while with them had the distinction of fitting out and operating the first cable operated dipper dredge. Latterly he was with W. J. Poupore & Company, of Montreal, and R. Weddell & Co., of Trenton. At the present time, as indicated above, he is with the C. S. Boone Dredging & Construction Co. He was also connected with the Toronto Shipbuilding Company and at present is a director of the Toronto Drydock Company.

Mr. Manley is one of the young old men in the construction business. He is hale and hearty and his actions belie his years. Although in a position of high administrative responsibility, he knows the practical end of the business from A to Z and, when necessary, he can handle a set of levers and ride a foot board of a crane on any of the modern machines, either a dredge or a steam shovel, as well as the best of them.

Mr. John J. Manley

Protection of Windows from Fire Essential Qualities of Good Shutters—Every Building Has Its Own Problems

THE types of modern window protection from fire may be divided into three classes, namely, water jets or open sprinklers, metallic shutters, and metal or metal-covered frames in combination with wired-glass. Open sprinklers, or "water-curtains," have been subjected to no very severe tests, although they are often advocated even to the exclusion of shutters. This dependence does not appear to be justified, as water is diathermanous and permits radiant heat to pass through it readily. The greatest value of open sprinklers lies in the reinforcement they provide for other measures of window protection, such as fire-resistant shutters and wired-glass windows.

Shutters have proved their efficiency in many fires, but they are unsightly. For rear walls of warehouses and factories they may be unobjectionable, but, in a building occupied by tenants, any systematic method of closing them would be hardly practicable. A further objection is the fact that, if such shutters are closed at night, internal fires may attain serious proportions before discovery. Rolling shutters of the normally open automatic type do not possess these objections, but they are far more costly to install. Shutters in any form should combine the following requisites: (a) Fire resistance; this is dependent upon the material of which the shutter is made and upon the way in which it is installed. (b) The ability to resist radiation of heat. (c) Capability of being opened from the outside. The last-named feature is essential, that firemen may have access to interior fires or that the shutters may be opened to permit the escape of entrapped inmates.

Where the danger of exposure is not sufficient to necessitate the use of shutters, or, if their appearance is objectionable, wire-glass in metal or metal-covered frames forms a pleasing though less efficient type of protection. Wire-glass windows, however, readily admit radiant heat, and are not to be recommended for severe exposures unless used in combination with shutters or outside sprinklers.

As a rule, with light exposures of first-class construction 75 feet or more distant, open sprinklers should be sufficient, except for a risk particularly dangerous in itself. If the exposure is moderate at 40 or 50 feet and the building is not specially hazardous, wire-glass would be preferable. If the exposure is severe and within 25 to 40 feet, tin-covered shutters should be used where attractive appearance is not essential. If the exposure is less than 25 feet distant, tin-covered shutters in combination with wire-glass or open sprinklers may be used.

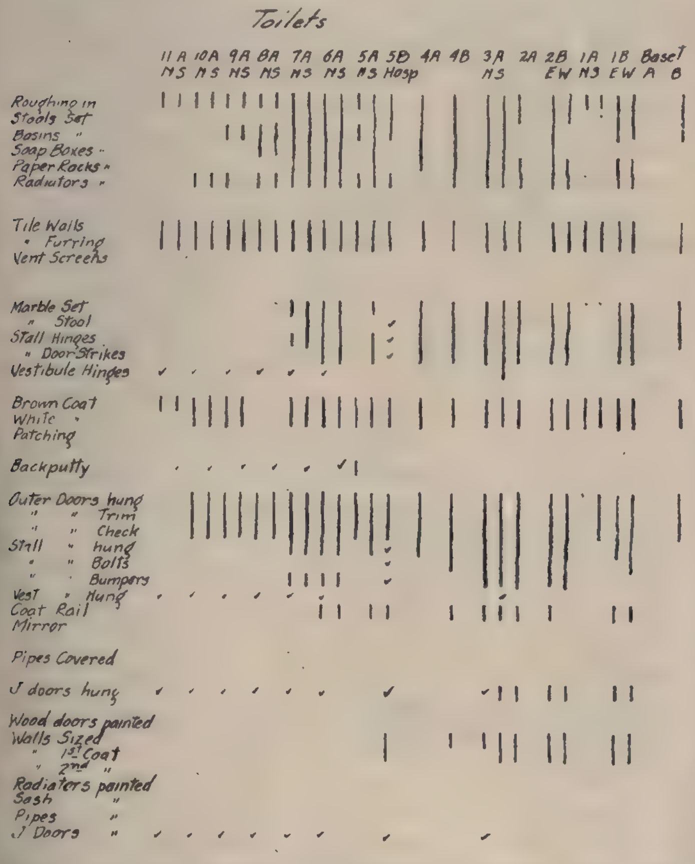
Hints for the Contractor

That May Save Him Time and Money—We Will Pay for All Accepted Items—Send One In

How a General Superintendent Checks the Completion of Details

A GENERAL superintendent, travelling about from job to job often finds great difficulty in checking the completion of details. Particularly is this true as work nears completion, or when the owner has taken partial occupancy. There are often a myriad of items yet to be cared for which require some means of following up other than inspection and memory.

Wells Brothers Construction Co. makes use of check sheets which permit quick analysis of progress.


Toilets
11A NS
10A NS
9A NS
8A NS
7A NS
6A NS
5A NS
5B Hosp
4A
4B
3A NS
2A
2B EW
1A NS
1B EW
Base't A
B
Roughing in
Stools Set
Basins "
Soap Boxes "
Paper Racks "
Radiators "
Tile Walls
" Furring
Vent Screens
Marble Set
" Stool
Stall Hinges
" Door Strikes
Vestibule Hinges
Brown Coat
White "
Patching
Backputty
Outer Doors hung
" " Trim
" " Check
Stall " hung
" " Bolts
" " Bumpers
Vest " Hung
Coat Rail
Mirror
Pipes Covered
J doors hung
Wood doors painted
Walls Sized
" 1st Coat
" 2nd "
Radiators painted
Sash "
Pipes "
J Doors "

Check sheets of this character enable progress to be analyzed by superintendent.

The accompanying check sheet is one used on work of the National Cloak & Suit Co. at Kansas City, an eleven-story warehouse of 69,000 square feet of floor, which was occupied with a full force on January 26, while considerable work remained to be done. The owners desired the quickest possible cleaning up in order to avoid constant hindrance to efficient operation.

The check sheet shown covers the item of "toilets" which always require considerable watching. At the left are itemized the details, and across the top are column headings 11-A, 10-A, 9-A, etc., representing floors in "A" and "B" building and the N. and S. refer to north toilet and south toilet, respectively. In each column a vertical heavy line indicates the work as completed, a check mark indicates absence of that detail in that particular toilet and a blank shows work yet to be done.

When the general superintendent demands records of this sort from the superintendent and the superintendent on the job follows these sheets for daily execution, there is nothing left to memory, and if there is blame for non-execution it can be put on the right shoulders. Colored pencils may be used to show progress as between weeks, black for the initial week of the record and a new color for each succeeding period. This parallels the construction record commonly employed on railroad work where excavation, fill and other items are drawn in day by day on cross section paper, giving at the end of the job a complete chronological record of progress.

Silicate of Soda Solution is a Quick and Effective Waterproofing Agent

By F. A. McLean*

WHEN building concrete tanks, hot wells, cesspools, etc., or when lining the walls of tunnels and shafts it is often necessary to waterproof the concrete to prevent leakage. There are a number of good compounds on the market that are recommended for this work which can be used with splendid results but they are not always obtainable at the time they are needed most. Where this condition of affairs exists the following methods are easy to use and will be found quite effective. The first method is to paint the concrete with a solution of one part of silicate of soda (water glass) to five parts of water. The first coat should be allowed to dry for about six hours before applying the second. Repeat this process until four coats have been applied. In the second method the walls are painted with a mixture of 8.75 pounds of sulphate of zinc (white vitrol) dissolved in one gallon of water. The zinc sulphate acts on the lime in the concrete forming compounds of calcium sulphate and zinc hydroxide which readily fill up the pores in the cement. Whichever solution is used, the surfaces to be treated should be thoroughly cleaned before the coating is put on.

Canada Wire and Goods Co. Issue Catalog

The Canada Wire & Iron Goods Company, Hamilton, Ont., are distributing a catalog, entitled, "Wire Rope & Fittings." The catalog is well illustrated and contains a quantity of valuable information about the products of this company. They are now making wire rope and have facilities for manufacturing rope of every description, up to 2 in. diameter. Their plant is said to contain the very finest wire rope making machinery.

---

*Of Canadian Ingersoll-Rand Co., Sherbrooke.

Mainly Constructional

East and West—From Coast to Coast

In future the City Architect's Department, Toronto, will be known as the Department of Building, and the City Architect as Commissioner of Building.

The province of Saskatchewan's bridge building programme for this year calls for an expenditure of $200,000, and includes bridges of both steel and concrete types.

A by-law authorizing the expenditure of $371,000 for the erection of a rapid sand gravity filtration plant at Chatham, Ont., will be submitted to a vote of the ratepayers on April 14 next.

The Housing Commission of Dundas, Ont., at a recent meeting, appointed the following officers: Mayor, E. J. Mahony, chairman; S. Hughes, vice-chairman, and H. B. Wilson, secretary.

The Housing Commission of London, Ont., has 54 houses on its programme for the present year. The need for accommodation in this city is very urgent and tenders have already been called for the construction of the above houses.

Preliminary work has been commenced by the Public Utilities department of London, Ont., on the construction of the new 10,000,000 gallon water reservoir. This reservoir, when completed, will provide sufficient storage capacity to supply all the requirements of the city for several days in the event of a drought.

Preliminary steps are being taken to establish a waterworks system at Port Dalhousie, Ont. The sum required to carry out this project will be $120,000, and the Port Water Commission has asked the town council to issue debentures for this amount. A sewerage system will likewise be installed at a cost of $30,000.

Montreal is to have a new 10-storey office building at the corner of St. Lawrence Blvd. and Notre Dame St., which will cost in the neighborhood of $500,000. The building will be of fireproof construction throughout and will be built of reinforced concrete with an artificial stone facade. Mr. J. Asselin is the architect.

It is stated that damages to bridges as a result of the recent floods, in Annapolis county, N.S., will be at least $10,000,000, and it will be several months before vehicular traffic across the Annapolis and Lequille Rivers can be fully resumed. Four steel bridges, two wooden bridges and several small bridges were badly damaged.

An announcement from Ottawa states that the sum of $5,500,000 has been put in the estimates for the purpose of resuming work on the Welland Canal. Work was stopped last fall through labor troubles. No word, however, has been received up to the present time, according to chief engineer Grant, ordering the resumption of work.

Ald. W. A. Dixon, chairman of the Board of Works, Galt, Ont., resigned that position recently, following the city council's decision not to do any paving work this year. Council in the past has always endorsed the good roads policy, but gives high prices and difficulty of obtaining materials as the reasons for its decision this year.

Construction in Vancouver and district during the present year will be on an extensive scale and will involve, it is estimated an expenditure in the neighborhood of $15,000,000. The following are a few of the more important projects planned: New drydock, $3,500,000; C. P. R. piers, $2,000,000; Dominion government wharves, $1,500,000; two department stores, $2,000,000; three new theatres, costing $500,000, $500,000 and $300,000 respectively; new hospital, $500,000; new schools, $1,000,000; hotels, apartment blocks, etc., $2,000,000. A large number of residences will also be built throughout the city during the present year.

Personal

Mr. H. R. Simmers, assistant plumbing inspector, Vancouver, has been appointed chief inspector, succeeding Mr. Morgan.

It has been announced that Major-Gen. Sir David Watson has been appointed chairman of the Quebec Harbor Commission, succeeding Senator L'Esperance, who has resigned the position because of ill-health.

Messrs. Louis O. Secord and Herbert E. Murton, architects of Hamilton, Ont., have formed a partnership under the firm name of Secord & Murton, and have located in the Home Bank Building, James St. North.

Mr. Alcide Chausse, architect, of Montreal, was re-elected chairman of the Committee on Fire Prevention of the American Society for Municipal Improvements, at a recent meeting of that association, held at Buffalo, N. Y. It was stated, in error, in the personal column of our March 17th issue, that Mr. Chausse had been elected president of the society.

Mr. Ernest Drinkwater returns to St. Lambert, Que., as town engineer, after a period of private practice. He is an Englishman by birth, and came to this country in 1902. Before being appointed, in 1912, engineer for the town of St. Lambert, he was engaged on street railway work and power house construction. While in practice he installed a waterworks system for South Montreal. Mr. Drinkwater is an associate member of the American Society of Civil Engineers.

Obituary

Mr. Arthur Barre, head of the contracting firm of Barre & Charron, of Granby, Que., died recently in that city at the age of 41 years.

Mr. Arthur Dinnis, president of the general contracting firm of Richard Dinnis & Son, Toronto, died in that city recently, following a sudden attack of heart trouble.

Malcolm McMillan, president of McMillan Bros., Ltd., railway contractors, Winnipeg, died recently in that city after a lingering illness. Deceased was born in Bruce County, Ontario, and had been a resident of Winnipeg for the past forty years.

Mr. Alexander Garvock, well known contractor of Ottawa, Ont., died recently in that city at the age of 79 years, as a result of heart disease. Mr. Garvock personally supervised his building works up till about a year ago, when he was forced to retire through ill health. He had been actively engaged in construction work in Ottawa, since 1884, and built many of the city's churches, schools and office buildings.

Trade Incorporation

Cross Builders' Supply Co. Ltd., with head office at Windsor, Ont., capital $100,000.

Montreal Building & Construction Company, Ltd., with head office at Montreal, capital $100,000, to carry on the business of builders, contractors and engineers.

Canadian Metal Window & Steel Products, Limited, with head office at Toronto, capital $250,000, to specialize on the manufacture of metal window sash, doors, etc.

ESTABLISHED 1886

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Not Fair to Ask Contractors to Take Such Risks

THE contracting industry has been somewhat "agog" over the recent report that A. Sande, so called consulting engineer of Hamilton, Ont., had suddenly disappeared and taken along with him the cash receipts of the marked cheques of a number of Canadian contractors. One report had it that 47 contractors had each contributed $2,500 to Mr. Sande's southern tour, but this, like the famous report of Mark Twain's premature death, seems to have been greatly exaggerated.

The fact seems to be, however, that this man Sande was either insane or a very deliberate rogue, for it is known that he has withdrawn funds not belonging to him to the extent of something over $10,000. These funds came into his possession in the form of marked cheques which accompanied tenders on the construction of a pulp mill supposedly somewhere in Quebec. One of the un-understandable things about the matter is that some of the cheques were returned —the receipt of two at least being acknowledged by Eastern contractors.

But the moral that seems to be pointed by the whole circumstance is that contractors should never have been asked to place the sum of $2,500 each in the hands of a perfect stranger. The wonder is not so much that Sande has run off with this money as that something of the sort has never happened before.

Surely there is some way of protecting the contractor. We understand the members of the Montreal Contractors Association have agreed to refuse to bid on any work unless a surety bond is accepted instead of the marked cheque. This would have saved the Hamilton situation. Why not make it a universal custom ?

Published Report on Quebec Bridge is Excellent Reference Work

WITH a view to perpetuating the facts leading up to and immediately connected with the design and construction of the Quebec bridge, the Governor-General-in-Council has authorized the publication of the final report of the Government Board of Engineers. The report, as just off the press, is a really monumental work, in two volumes; the first largely descriptive and illustrative of the leviathan structure, and the second containing the detailed structural drawings arranged in 111 plates. The first impression following an examination of the report is that no expense has apparently been spared to make the work as complete as possible. Every detail is elaborately described and fully illustrated with cuts that are exceptional for their clearness and precision.

To the lay reader the publication has a very significant interest. The historical background of the bridge, the facts leading up to the adoption of the present design, the outstanding and remarkable features of its construction are all dealt with in a manner that will greatly interest the non-technical reader. It is not too much to expect, even, that a volume of this character in the hands of a layman, will induce him to appreciate more completely the great engineering achievements of our own and other times.

It is to the technically trained, however, that the report especially appeals. Bearing the joint authorship of Messrs. Monsarrat, Borden and Modjeski, it is bound to be religiously correct in every detail. More than that, the engineer authors have prepared the material with that thoroughness that characterized their more practical activities in connection with the bridge itself. Not only is the design of the structure illustrated in every particular, but intimate comparisons are made with other designs which came up for consideration. No detail, however insignificant, appears to be slighted, and in the more practical description of construction the same painstaking care is exhibited. With the completeness of word description and pictorial illustration, no engineer or contractor can fail to follow the hundreds of operations involved.

As a record alone, this publication is valuable. Canada is justly proud of the Quebec Bridge and proud of the fact that it is a distinctly Canadian undertaking, designed and built by Canadians with a success that is a tribute to the skill and ingenuity of Canadian bridge builders. The report, we are glad to see, justly gives credit to the St. Lawrence Bridge Company for having grasped the opportunity of demonstrating what Canadian talent could accomplish, and also for having seen the advantages of a new type of design and applying it to the construction and erection of a bridge of this size.

Every engineer can well afford to have a place in his library for this final report of the Government Board of Engineers. Whether connected with the bridge or not, he should be concerned with it, to the extent at least of keeping available a record of its success. The Department of Railways & Canals has produced a limited number of copies and states that it is ready to forward these on application accompanied with $6, the nominal charge for the two volumes.

Unorganized Territories of Ontario are Demanding Better Highways

NO better indication of the interest being displayed in the movement for better highways is afforded than in the Conference of the Inspectors of Colonization Roads, which was held in Toronto a few weeks ago. The representatives at this convention come from the great north country of Ontario, where we, in the more populous centres, are inclined to believe that roads are next to unknown. However, one had only to witness the interest and enthusiasm exhibited by the delegates and to follow the discussion and debate which ensued during the two-day meeting to have proof positive of the impetus that the good roads movement is acquiring and the important place it occupies in the public mind.

The Department of Public Highways of Ontario does not exercise jurisdiction over roads in the new Northland. These come within the scope of the Colonization Roads Branch, which is under the direction of the Department of Lands and Forests. A great deal of good work has been accomplished by this Branch in the sixty years of its existence, but the convention referred to was the first gathering of its representatives ever held. The object of the convention was the co-operation of the inspectors with the staff of the Department for their enlightenment and education and for the exchange of ideas, opinions and experiences on the practical methods of building colonization roads.

We are inclined to forget the important work that is required of the Colonization Roads Branch. The chief object of that department of the government service is to aid communities in the sparsely settled areas and unorganized territories of Ontario to build their roads and bridges. This is done by direct grant and by by-laws passed by the municipalities. While the Department of Lands & Forests, through the Colonization Branch, has assisted townships and other territories in the northern part of the province, it has also undertaken the work of building trunk roads in Northern Ontario. This particular part of the work is now under the jurisdiction of the Northern Development Branch, which was created in 1912 to take charge of the construction of main roads in that district. Already several hundreds of miles of first-class highways have been constructed and many permanent bridges have been erected.

This part of the road administration of the Province of Ontario has a vast responsibility on its shoulders. Northern Ontario has too long been regarded as an inaccessible wilderness, but these colonization roads are proving essential factors in its development. While very substantial efforts have already been made, there is much yet to do, and as a means of better accomplishing the purpose of the Colonization Roads Branch, this first conference of inspectors will undoubtedly be of great moment.

A Suggestion for Manufacturers Supplying Western Canada Markets

A FIRM of contractors, operating in Western Canada, offer a timely suggestion with regard to the quotation of prices in catalogues and other literature, which manufacturers and wholesalers may think worthy of consideration. We quote from a letter just received:

> "We would like to suggest to the Eastern advertisers in your valuable paper that they would be more likely to obtain business from the West if they would only send out prices with their literature. When a contractor needs either equipment or supplies, he generally needs them quick—and there is not time for him to write East and wait for replies, so the local man gets the order."

Building Regulation on Zoning Method Favored for Montreal

THE Montreal Builders' Exchange favor the construction of higher buildings in the city, subject to regulation under the "zoning" system prevailing in many large cities. Following is the text of a resolution passed by the board of directors:

Whereas, the board of directors of the association believe that it is urgent that the whole situation with respect to the location of the various classes of buildins, such as manufacturing, residential, office buildings, and also the height of buildings in Montreal, should be carefully studied, and whereas the board of directors consider that the entire city of Montreal and surrounding district should be divided into definite "zones" similar to other large cities, it is resolved that the board of directors urge the Administrative Commission of the city of Montreal to appoint a committee to study the whole question of "zoning" and also the question of the height of buildings in the respective "zones," and present a report, including "zoning maps," etc. to illustrate same; and that the board of directors of this association go on record as favoring a substantial increase in the height of buildings, providing such buildings are properly restricted by regulations similar to those at present in force in New York city, and also, providing that tall buildings are restricted to definite "zones" in the city and not permitted to be built where they would affect residential and other similar properties.

New Sales Office

The Asbestos Mfg. Co., Limited, manufacturers of asbestos shingles, slates, etc., Montreal, have opened a sales office in Toronto, with Mr. Grant Sclater in charge.

No. 18

Canada's Engineers—Henri Ortiz

Mr. Henri Ortiz, assistant engineer in charge of the road department, Montreal, has recently been appointed manager and engineer of the town of Grand'-Mere. Under an agreement entered into between the Laurentide Company, Limited, and the town council of Grand'Mere, P.Q., the company agreed to spend for the welfare of the town the sum of $50,000 per annum, and will install a water works system from plans by R. S. & W. S. Lea, Montreal. It was also agreed that a town manager be appointed by the company and town council, his salary being paid by the company.

Mr. Ortiz received his technical training at the "Ecole Polytechnique de Montreal," where he graduated with honors in 1907 in the civil engineering course. After graduation he entered the service of the Federal Government as assistant engineer in charge of the hydrographical and topographical survey of Lake of Two Mountains. In 1909, he prepared, under the direction of Commander I. B. Miles, of the Royal Navy, maritime charts of the St. Lawrence River. In 1911, he was appointed by the Department of Public Works of Canada, assistant-district engineer for Quebec, in which capacity he had responsible charge of all improvements to the harbors of Quebec and Levis, works comprising the deepening of the harbors, the construction of concrete wharves, etc., the cost of this amounting to over $1,000,000. In 1913, he resigned from the government service to engage in private practice, designing and superintending the construction of the Quebec "Arena" and acting also as consulting engineer to the "Compagnie Generale d'-Entreprises Publiques" of Levis.

In July, 1913, he was appointed chief engineer of the Dominion Dredging Company of Ottawa, and had charge of all construction work on section No. 1 of the New Welland Ship Canal. This contract amounted to $3,850,000 and included among other items, the following: 360,000 cubic yards of mass concrete, 160,000 cubic yards of reinforced concrete, 6,000 tons of steel reinforcement, 4,000,000 cubic yards of excavation, 3 miles of trestles, 2 miles of double track railway, 2 bascule bridges, the construction of the harbor at Port Weller, etc. When the government closed down all work on the Welland Canal in order to devote all the financial resources of the country to the prosecution of the war, Mr. Ortiz entered the service of the city of Montreal and occupied successively various important positions in the sewer department, the bureau of designs and surveys and the road department. While in the employ of the city he designed and superintended the construction of many municipal improvements.

Mr. Henri Ortiz

Meeting of the Executive Committee of Association of Canadian Building and Construction Industries

The executive committee of the Association of Canadian Building and Construction Industries met at Montreal on March 18th. Among other items of business under discussion were the completion of the National Council, and the institution of a campaign for new members.

Several matters, arising from the reports of various committees of the recent conference in Ottawa were considered. It was decided to place the report of the Committee on Business Relations on the table until the meeting of the National Council.

In reference to the recommendation of the Committee on Standard Practices, it was decided to appoint four representatives, to confer with two to be appointed by the Engineering Institute of Canada, and two by the Royal Architectural Institute of Canada, with a view to working out uniform standard contract and general conditions, and other standard forms. The following were appointed to represent this association: H. T. Hazleton, Winnipeg; J. B. Carswell, Toronto; K. D. Church, Montreal, and J. K. Thomas, Calgary.

The report of the Committee on Labor was discussed, and it was decided to appoint a standing committee on labor, to endeavor to carry out the recommendations of the Conference Committee, and meet with the representatives of organized labor. The committee was: J. P. Anglin, chairman, E.G.M. Cape, Montreal; C. B. Jackson, R. J. Fuller, Toronto; G. A. Crain, H. J. Graham, Ottawa; E. R. Dennis, London; Roy Secord, Brantford; J. W. Pigott, Jr., Hamilton; F. W. Dakin, Sherbrooke; Jos. Gosselin, Jr., Levis; Wm. Wilson, Regina; and one to be appointed from Winnipeg and one from Calgary.

The executive felt that in addition to the work outlined by the Conference Committee report, this Standing Labor Committee should endeavor to encourage the idea of the organization of a Canadian executive of Organized Labor in the Construction Industries of Canada, and the formation of an Industrial Council for Canada to deal with Canadian-wide labor questions in the building trades. This information has been communicated to the Trades and Labor Congress of Canada and to the Minister of Labor.

The invitation received from the Winnipeg Board of Trade for the Association to hold its next conference in that city was favorably regarded, and referred to the National Council for further action.

The president, Mr. J. P. Anglin, was elected official representative to the Convention of the National Federation of Construction Industries, in Chicago.

Nova Scotia Makes Plans to Secure 9000 Miles of Good Roads in Five Years

Provincial Highways Board Proposes Expenditure of Eleven Million Dollars on an Extensive "Forward Movement"—Abandonment of Haphazard Maintenance

ELEVEN million dollars to be spent in the next five years on road improvements in Nova Scotia is a feature of the very ambitious program recommended by the Provincial Highways Board. This sum will be further augmented by federal aid, provided under the Canada Highways Act. This year's apportionment of the sum is over $2,500,000. In brief, the scheme which is very progressive, provides for the improvement of 9,000 miles of highway, on a plan that will largely solve the road question as far as Nova Scotia is concerned. In keeping with the progressive plan of construction, the Provincial Highways Board has intimated that a more advanced scheme of maintenance must be adopted and the old lackadaisical methods abandoned. The essential features of the proposed policy are described in this article, which is based on the report made by the Provincial Highways Board, consisting of Messrs. W. G. Clarke, W. Crowe, Thos. Cantley, Percy C. Black and James K. Kelleher.

The amount which will accrue to Nova Scotia under The Canada Highways Act is about $300,000 for each year of the five year period, or to be accurate $293,744.00, and to secure this aid the Province must spend on approved projects $450,000 for each year in the same period, or to be exact $440,616. In other words, if a five year programme is adopted there will be available about $1,500,000 of federal money, to secure which must be added $2,250,000 of Provincial money, or in all there will then be available $3,750,000 for the construction, reconstruction and improvement of carefully selected portions of the roads in Nova Scotia.

Assuming that the Province will take advantage of the Federal Act, and will provide its share of the funds required, the Board has some "projects" ready to put forward, and surveys are in progress for others.

The character of the road has been discussed with the Commissioners who will administer the Federal Act, and they agree that a road of proper width, well drained, and surfaced with good wearing material, would be of a standard to secure federal aid. The Board's engineer advises that the average cost of such a road in this Province will not be less than $4,000 per mile; whether contractors will build for that figure remains to be seen. In the light of the Board's experience of rising cost of labor material, the figure is not excessive. Many miles of such road, particularly on the southern shores of the Province will cost very considerably over $7,000 per mile.

The federal aid money should, in the opinion of the Board, be devoted toward helping to provide a system of main or provincial roads, say about 1,200 miles in extent, and at the figure stated would in the five year period overtake and reconstruct 900 miles of these.

In the first years of the five year period the first rate of progress will be slow, it being advisable to undertake the reconstruction of the worst parts of the system; these will be of course the most expensive portions, and in these years cost of the reconstruction will be above the average price stated above.

Clamoring for Good Roads

The federal aid programme will do much toward satisfying the growing needs of the province for better roads, but the rate of progress is too slow. The towns and cities are insisting that their highway taxes shall be expended on the thoroughfares leading into them; the motor owners are clamorous for better roads everywhere, and are claiming that they are paying in license fees sufficient moneys to warrant better roads, and the farmers all over the province, whether living on primary or secondary highways, demand with justice that they are entitled to consideration. In the judgment of the Board, the time has come for the province to deal with the road problem in a large and generous way.

The first consideration, if an extensive forward policy is to be entered upon, is the re-organizing and strengthening of our force in the field, and as a corollary to that, certain increases to the head office staff will be necessary. The services of competent engineering talent must be freely drawn upon if we are to build roads to comply with federal standards, and these services will be available if it is decided to carry the improvement of our highways beyond the point contemplated by the federal act.

Province Divided Into Ten Areas

The division of the province into ten residencies or areas is suggested, each to be in charge of a resident engineer reporting direct to the chief engineer or his deputy, the present office of district engineer to be abolished. In each of these residencies or areas a sufficient number of superintendents to be appointed so as to make it possible for them to instruct the foremen carefully as to the work to be done, and possible also that they shall return frequently to the work as it progresses and see that it is being carried on properly.

Carrying this method of organization still further down, an ultimate area is contemplated of from 40 to 60 miles of road to be in charge of a working foreman or overman, so that during the whole of the year there shall always be some one definitely charged with the care and oversight of every mile of highway in the province.

The Board recommends that the present assistant chief engineer, with an assistant if necessary should give his undivided time and attention to the care and oversight of all the bridges in the province, large and small. All these, including culverts, should at once be thoroughly inspected both as to foundations and superstructures, and listed; and this inspection should be kept up consistently from year to year so that the Board may know at any time the exact condition of any given bridge, and the annual amount required to keep all in order from year to year. The traffic over these bridges is increasing and the Board regards a bridge department, under the chief engineer, as a matter of some urgency.

The second consideration regarding a forward policy is the scope and extent of it, and this we propose to discuss in the light of the Board's two years' experience.

A Provincial Scheme

In the opinion of the Board the province will not be satisfied with the 900 miles of reconstructed and improved roads which the federal aid plan will provide within five years, and we recommend the borrowing of money to supplement it. This we shall call the provincial programme.

Material to a consideration of this provincial programme is the mileage and classification of our roads. Short of an accurate survey, which will take time, we have been forced to act upon such information as we could secure from detached surveys, reports of superintendents, etc., and are inclined to the belief that the mileage of the provincial roads does not exceed 15,263. This figure is, of course, subject to correction as more accurate information becomes available.

For present purposes, though this classification is not unalterable, the roads have been divided into two classes:

Class I. includes that mileage of roads heretofore generally known as trunk roads, or those roads connecting counties, and also all the county roads of chiefest importance, the total mileage of which will be about 4,000. Class II. will include the rest of the roads, 11,263 miles.

It is not intended that this classification shall remain fixed or unalterable, but that there shall be some elasticity about it—thus, if any road under Class II. develops a traffic, it may be placed in Class I., the factor being the traffic the given road is called upon to bear.

Sixty Miles of Trunk Roads Per Year

The Board's recommendation as to Class I roads is that in addition to reconstructing and completing to federal standard an average of 180 miles yearly, we should, under the provincial programme reconstruct and improve a further 60 miles annually of the provincial trunk roads for five years.

There would then be left 2,800 miles of Class I roads requiring treatment. The recommendation is that 560 miles of these be taken in hand each year for five years at an average cost of say $1,500 per mile, which amount should bring these roads to the point of surfacing with gravel or other suitable material.

Regarding the roads of Class II, it is recommended that preliminary work to the extent of $500 per mile be undertaken on 1,000 miles of these roads annually for the next five years.

The standard in view for Class I roads is a well drained, well shaped, well gravelled road, and that for Class II a similarly constructed earth road, unless, of course, where natural conditions favor a better surface. The combined results of the federal and provincial policy suggested would give the following results:

One hundred and eighty miles of roads of Class I built to federal standard, or in five years	900	miles
Sixty miles of roads of Class I built to Federal standard, or in five years	300	"
Five hundred and sixty miles of roads of Class I ready for surfacing, or in five years	2800	"
One thousand miles of roads of Class II reconstructed, or in five years	5000	"
Total improved roads	9000	"

With the completion of such a five year programme the road question in its most pressing phases would be solved, as it is fair to assume that with so great a mileage of improved highways the tax payer would realize the benefit of good roads, would cheerfully provide the amounts required to complete the remaining mileage and maintain all in good condition, and besides the growth of the province in population and wealth would make the provision of funds not so insistent as at this time.

The Financial Aspect of the Policy

It is, of course, economically unsound to borrow money to maintain the roads, and these recommendations do not suggest that course; but the state of by far the largest part of the mileage of the roads is such that a great deal of work preliminary to their finished condition has necessarily to be done, and which once done need not be repeated. Thus, expenditure for permanent drainage, removal of boulders and that much of reconstruction involved in properly widening and shaping the road and preparing it for an ultimate hard wearing surface are for a class of work which warrants the borrowing of money on a bond issue maturing in not more than twenty years, always provided adequate provision is made for subsequent annual maintenance.

In connection with both the federal and what has been called the provincial programme, it will be necessary to procure labor-saving machinery, such as motor trucks, etc., and we recommend that substantial amounts be borrowed for this purpose.

Herewith is summarized the amounts which should be placed at the disposal of the Board over a five year period, for the purposes suggested. The amounts named below do not include the amount to be received from the federal government:

	Proportion required in 1920	Total to be borrowed in five years
For expenditure necessary to secure federal aid for five years, which will provide for the reconstruction of 180 miles per year or 900 miles over the five year period	$ 450,000	$ 2,250,000
Amount necessary to reconstruct 60 miles each year of Class I roads to federal standard, at $4,000 per mile, or 300 miles in five years	240,000	1,200,000
Amount necessary to reconstruct 560 miles each year of Class I roads, at $1,500 per mile, or 2,800 miles in five years	840,000	4,200,000
Amount necessary to reconstruct 1000 miles each year of Class II roads at $500 per mile, or 5000 miles in five years	500,000	2,500,000
Amount necessary to provide machinery for construction purposes as needed, the plant to be let on hire to contractors if necessary ...	500,000	500,000
Amount necessary to be borrowed each year for five years to provide machinery for maintenance and patrol purposes	75,000	375,000
	$2,605,000	$11,025,000

Attention is now directed to the question of maintaining the roads in their present condition while the reconstruction programme just outlined is being carried on. The Board cannot maintain the roads in their present state unless more money is provided. As rapidly as roads are reconstructed or improved definite sums of money must be provided for their upkeep. Indeed, as regards the federal aid roads, the province must agree to maintain them and provide all necessary renewals and repairs "so as to preserve the standard of construction of the completed highway."

The necessity of properly maintaining any roads reconstructed from other funds is just as obvious. There are many sections of main roads reconstructed during the last two seasons upon which patrols, equipped with light motor trucks and other usual repair machinery, must be established, and the Board intends providing such a patrol system the coming season. The old system of having the "road work" done when convenient in the spring and then leaving the road alone till next year must now be definitely abandoned.

Advantages of Rolling Bascule Bridges

Maximum Clearance of Waterway Obtained by Span Rolling Back on Solid Foundation—Nearly 300 of this Type Now in Operation

By Walter P. Chapman

THE Rolling Lift Bridge, examples of which are illustrated and described in this article, was invented and patented by the late Wm. Scherzer, of Chicago, about 1893. Since that date improved features of construction and operation have been embodied tending to obtain greater efficiency. At this date there are between 250 and 300 rolling lift bascule bridges in successful operation in various parts of the world.

The cuts are illustrative of some of the many different designs in operation, all of the Scherzer type, having the fundamental principle of rolling back on a solid foundation giving a maximum clearance of water way not possible by any other type of bascule. From these it is readily seen that the design is adaptable to every opening required by the navigation interests.

Structural Features of the Rolling Bridge

A fuller description of the various features of the rolling lift are given below.

It is a simple, one piece, rigid, completely riveted structure. It requires no heavy pins, trunnions, core castings or bronze bushings. The modern rolling bearing is reduced to simplest elements ensuring endurance with high efficiency. The design of the segmental girders is to mesh on to the teeth of track plates. This prevents any possibility of wavering or lateral action of the moving leaf during operation.

On account of the perfect adjustable balance that can be obtained with this structure, only a very small amount of power is required to operate it.

The machinery required is of the ordinary universal kind as might be furnished by a small shop. The weight of machinery is exceedingly low. With normal conditions for a structure of, say, 100 ft. moving leaf, it would run closely 6 per cent. weight of metal, costing closely 12 per cent. of metal in bridge.

While settlement in foundation of a bridge of this type is to be guarded against as much as possible, a slight settlement would not prevent operation. Any defect in elevation of its rolling base is easily overcome by raising alternately the front and back unloaded ends of rolling span one inch or more as desired. By this method it would be possible to raise the grade of a railway or highway three or four feet after the structure is built, at a trifling cost.

With a minimum weight of inexpensive machinery, the cost of shop and erection work will be less. It will surely follow that the unit cost of all metal used in the structure will be lower.

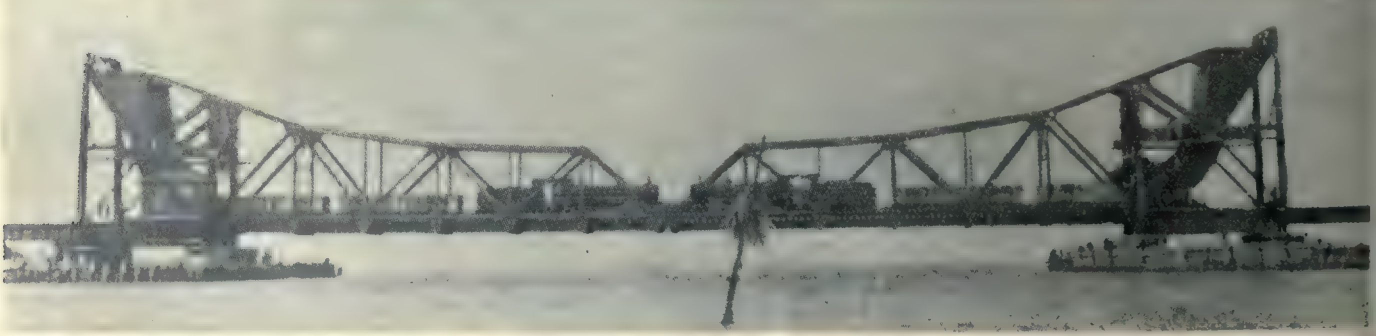
The counter weight is firmly and rigidly attached to the trusses or girders—an excellent feature.

Economical Material

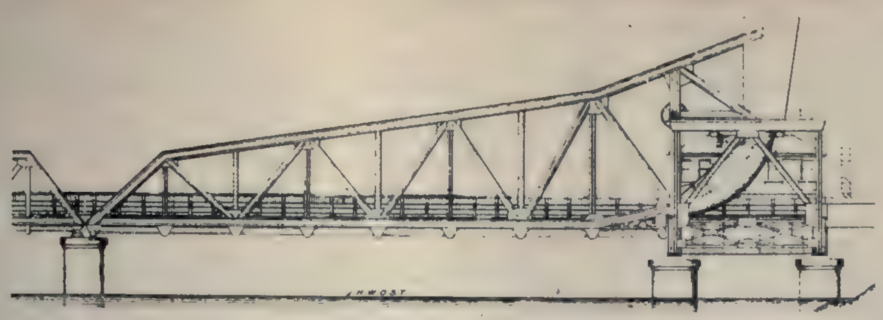
The rolling lift provides the maximum lever arm, and therefore permits use of more economical material for counter weight. It follows that less metal is required in excess of weight of span.

The perfectly horizontal movement of the operating shaft and gear, while moving with the segmental girders, is a modern feature of much interest and cannot be equalled for simplicity and efficiency.

After 25 years of successful operation of these bridges there is absolutely no record of any failure of a primary member due to frequency of operation. Re-



A view of a double leaf rolling lift bridge with a test load of locomotives and cars. This bridge is on the Indo-Ceylon viaduct



Elevation of the rolling lift bridge over River Trent, England, to illustrate general features of this type

cords show that bridges of this type have been operated over three million times with only cost of ordinary repairs, and that the average cost of operating and maintenance is lower than for any other type of bascule bridge.

Superfluous intricate movements are not common to this design. All parts are easily accessible for renewal or repairs, as in the ordinary fixed structures. In the matter of artistic appearance embodying all the features of efficiency, it is unexcelled.

It may be of interest to briefly compare this bascule with the swing bridge. The bascule operates more rapidly, with less power. It will give a clear opening for navigation, without narrowing the channel by an obstructing centre pier, as for a swing bridge. The costly feature of a large swing bridge is the machinery item.

The writer has record of a modern double track swing bridge where the weight of machinery figures closely 15 per cent. total weight of metal, at a cost of 30 per cent. of the whole. It is not necessary to point out the increased cost as compared to a bascule with respective percentages of 6 per cent. and 12 per cent.

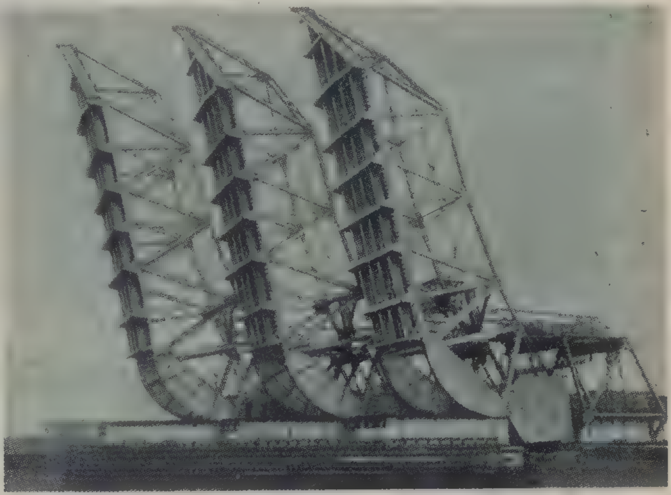
Reduces Number of Elements

With the bascule bridge, costly shafts and machinery for raising rails at ends of bridge, the heavy wedges and castings at both ends and centre of bridge are eliminated and the actual operating machinery is reduced to a minimum. The simple operation of locking or unlocking the bascule is performed by the operator in the cabin. For the operation of a bascule one man only is required.

A rolling lift bridge across the Rideau Canal on the Canadian National Railway

For a large swing bridge, on account of the more difficult and intricate operation, it is quite advisable in most cases to have two operators in constant attendance.

The bascule bridge in its open position acts as a barrier for one approach, closing the railway or highway upon it, thus absolutely preventing any serious accidents common to swing bridges.



A 8-gang six track rolling lift bridge on the New York, New Haven and Hartford Railroad near Boston

Another feature of the bascule is that duplicate bridges can be erected and operated side by side, providing double or triple accommodation the increasing traffic might demand on a right of way or street of the ordinary width.

The advantages of bascule bridges are recognized and becoming more apparent with the use of large vessels now being built and contemplated for future inland navigation. Inland navigation of rivers, canals and other channels generally means restricted waterway and slow speeds for vessels. Where such channels are obstructed by a bridge, whether it be a structure carrying railway, highway or other traffic, it invariably means further narrowing of the waterway, and slower movement of vessels using the channel. In these days of large vessels of deep draft it will readily be seen that it is greatly to the advantage of navigation interests that the main channels of inland waterways shall be as little obstructed as possible.

Objections of Swing Bridge

In the past it has been possible to meet the demands of navigation by the use of a swing bridge, giving one clear channel varying in width up to 120 feet. This width is not now deemed sufficient for large vessels, where the approaching channels may be 200 ft. or more in width. The centre pier of a swing bridge giving 120 ft. channel does so obstruct as to bring decided objection from owners and operators of large vessels, as tending to reduce the speed of their vessels and involving risks of striking the bridge during a gale or rough weather. It is now conceded that the unobstructed channel is most desirable, even at some additional cost, and the large navigation interests demand as a minimum 200 ft. clear channel.

To provide this by a railway swing bridge would require a costly structure about 450 ft. in length, the operating of which, even by electricity, would be likely to cause unnecessary delays to both railway and water traffic, full open operation being necessary for both large and small vessels.

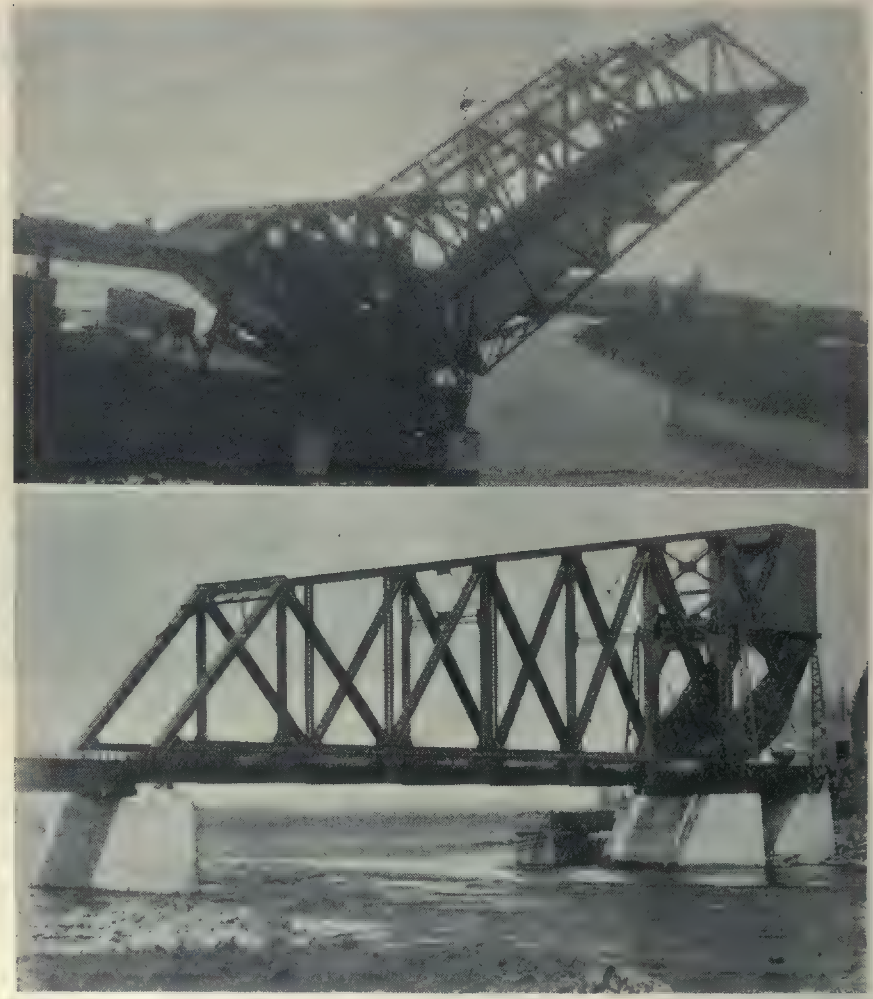
A clear opening of 200 ft. or over could generally be provided by a bascule, one or two leaf, bridge at less cost, requiring less time to operate, with lower cost for operation and maintenance. The costly items, machinery, castings, etc., would not usually exceed 60 per cent. of the same parts required for a swing bridge.

Full open operation of a bascule bridge is required for large vessels only. Partial operation only is necessary for a large percentage of small vessels, so effecting a saving in power and time.

The rolling lift bridge is a design of merit, embodying features of simplicity, strength and economy unsurpassed; the rolling back movement taking the structure clear of the channel is a feature of excellence, tending to safety for both the vessel and structure. The many structures of this type in successful operation are ample proof of its fitness to meet all requirements in its wide field of usefulness and ensures the success it deserves.

In outlining the various features contributing to this article the aim has been to appeal also to the public mind and the business community not necessarily familiar with the engineering problems, also the locomotive engineer and motorman passing over, and the captains navigating by or under such structures.

In these days of long distance travel by millions in every country, efforts tending to greater safety are generally appreciated. If this article contributes in a small measure to that end it will have served a good purpose.



Above—Canadian Pacific Railway Rolling Bridge over the McKellar River at Fort William, Ont.

Below—Another Rolling Bridge over the Rainy River, Canadian Side

$2,400,000 Voted for Montreal Aqueduct

The Montreal City Council has voted $2,409,639 towards the amount needed for completing the aqueduct for a water supply, and also for the general improvement of the water supply plant. The total cost is $4,500,000, so that the Administrative Commissioners will require to obtain the voting of a further sum.

Fixed Cost the Proper Basis in Construction

Author Claims That On Fixed-Price Contract, Owner is Fully Protected by Plans and Specifications and Contractor Must Carry on Work Efficiently to Make a Profit

MUCH has been written and said about the contractual relationship between the employer and the contractor in construction work. In other words, which is the better form of contract for both employer and contractor, the lump sum or unit price or cost plus a fee? This important question was the source of a very interesting discussion at the recent National Conference on Construction of the Associated General Contractors of America. The cost-plus-a-fee type of contract was advocated by Mr. F. A. Wells, vice-president of the Wells Bros. Construction Co., whose arguments were contained in an article printed on page 196 of the "Contract Record" of March 3rd. There are also those who pin their faith to the fixed-cost or lump-sum plan as is evidenced by the paper which we print herewith. This paper was read at the conference by James O. Heyworth, engineer and contractor, of Chicago. It is Mr. Heyworth's belief that on such a contract the owner is fully protected by the plans and specifications and the contractor must carry on the work efficiently to make a profit. He also is convinced that there is a greater degree of co-operation of labor on lump-sum contracts. His arguments in detail follow:

It seems to me only fair to the question and the economics of either theory that there should be excluded from the argument, first, emergency work that demands immediate action, for which there is no time to prepare sufficient plans and specifications, and second, work that must be prosecuted under extraordinary and abnormal conditions, such as war work or work done when nation-wide conditions are such that prices and delivery of material and merchandise and labor cannot be reliably contracted for.

Emergency work and work under extraordinary conditions, however, constitute such a small percentage of the construction work done in a nation's history, that it is not sound reasoning that such work should influence or have a bearing on the fundamentals and principles of the most desirable form of contract. Before I finish, I hope to show that this question is a two-edged tool which can cut both ways.

Any Contract Based on Confidence

The purpose of a contract between the two parties can be clearly and definitely set up. In the first place, there must be confidence between the parties, no matter what form of contract is made. The necessary steps should be taken beforehand by both parties to insure this confidence. The confidence necessary to both parties is, in a business way, based on, first the financial ability of the employer and the accuracy of his plans and specifications; second, on the past work and experience of the contractor and his financial status, to which should be added the personality of the contractor and his organization. These factors govern the confidence necessary to any form of contract. Last, the form of contract should be such that capital can determine its investment in order that its fixed charges may be established.

The employer has something to sell, but because of the fact that he is the eventual owner, he must exercise the right to select his buyer, selling to that one of them who bids the lowest. By this method, the employer can fully protect himself as to material, workmanship and finance. I know of no other form of contract which protects the employer as fully.

It is frequently argued that the employer cannot spend the time to do all this. As a matter of fact, employers and contractors who work under fixed-price contracts spend much less time and money in obtaining and carrying on work than do those who work under a cost plus fee contract. It must also be self-evident that the prosecution of work is quicker and cheaper when the experience, ability and judgment of the experienced contractor can be used at all times, immediately and when necessary, than when methods, purchases and decisions must be submitted to others for approval.

If construction is to be done according to plans and specifications, by what other standard than cost can be measured the ability of the contractor or the success of the work itself? Any balanced business man can perform any construction work in full accordance with the plans and specifications if the cost and time of completion are eliminated from the contract. This statement is proved in hundreds of cases all over the country. It is necessarily so, since the same construction men who actually do the work on fixed-price contracts can be employed

Loyal Organization Developed Gradually

During years of successful work and the solution of problems, there springs up between the fixed-price contractor and the men in his organization, including all labor, through lean and good years, a reliance of one upon the other—a loyalty to each other and a pride in the success of their organization because their success can be measured. If the work has cost more than they get for it, they have been a failure; if it has cost less than they get for it, they have been a success.

Necessity compels the contractor and his lieutenants to select and watch more carefully all the men in the organization; where cost is success or failure, the men themselves soon weed out the slackers and poor workmen.

Some say it is remarkable how much interest men, from superintendent to laborer, will take in work they are trying to do at a certain cost. It is not remarkable, however, when one realizes that in the heart of the majority of all men there is the same ambition to succeed, to win, but there must be a positive and final way of measuring this success so that they will know they have succeeded and absolutely won. The contractor can then reward this success because he has no doubts as to the success. Under what other form of contract except fixed-price contracts can success be measured, because the success must be satisfaction to both employer and contractor?

There is another significant factor which comes up in cost-plus-fee work which I have never heard brought out, but which I have noticed when observing work going on under each of the two forms of contract herein discussed.

Engineers, architects, contractors and employers have a general idea of about what a certain piece of work is going to cost. When the contractor takes a cost-plus-fee job, he urges and looks to his superintendents, engineers and foremen to do it as economically as possible and if they finish up too much in excess of original ideas, the field bosses are discharged, but the field bosses, from the beginning, have to depend on the skilled and unskilled labor on the job, and this labor, from the beginning, believes that the cost of the work does not directly affect their contractor or their organization. One frequently hears on a cost-plus-fee job from the laborer himself, this remark—"That means profit to the boss."

Field Bosses Need Labor's Support

This attitude of labor puts the field bosses in an impossible position to make good, which sometimes leads them to take chances on material, falsework, temporary construction or specifications, because failure does not come out of their contractor's pocket, whereas on fixed-price work, the field bosses do not dare because failure does come out of their contractor's pocket. This argument is generally made in favor of cost-plus-fee jobs; if it were true, it would mean that the field bosses are more concerned in their contractor's success than in their own individual success.

In other words, I claim the field bosses will be much more careful, painstaking and sure-footed on a fixed-price contract than on a cost-plus-fee contract, and much more able to deliver satisfactory results because they have the spirit and interests of the skilled and unskilled labor on the job.

Inasmuch as I have made an exception to what I believe is the better form of contract, it is reasonable that I suggest a form of contract to cover that exception, namely, emergency work, war work and work under abnormal conditions.

As I have endeavored to explain, no form of contract is satisfactory that eliminates from the heart of the men who actually do the work, the incentive of success, or that takes from them the pride and satisfaction of winning out by a standard that can be measured. You will note that I have confidence in the average human being and in the good that there is in the average human being; further, in the English, and especially in the American workman, there is a sportsmanship which must not be overlooked nor neglected. Why does the kid, the boy and the man, work his shirt wet and his muscles sore in the game, the hunt or the contest, except to win, hit the target or beat out the other fellow. It's the same spirit that gets into a bunch of men who are beating a price. Their satisfaction is in having won and in being rewarded in some way by the boss.

Suggested Contract for Abnormal Conditions

I would suggest a contract, to cover abnormal conditions, to be drawn in general along the following lines:

An estimate of the quantities and various items should be made and listed with a unit price for each. This should be made carefully and figured as close to actual cost as experience and price of materials and labor of the day will permit. Items should be extended and the total estimate ascertained. The fee for doing the work should then be figured at from twenty to twenty-five per cent. of the total estimate, as listed, according to the amount of plant furnished by the contractor and scheduled, less ten per cent. of the actual cost of the work refund to the employer. There should be a leeway of ten per cent. in the quantities either way in favor of the employer, but for increase of quantities over the ten per cent. leeway allowed, the contractor should receive cost plus a certain per cent. Rental of plant and equipment furnished by the contractor should be a cost item. To explain more fully, take the following example:

Suppose the original estimate, as listed, of five items ran as follows:

150,000 cubic yards excavation in earth	at $1.00..	$150,000
50,000 " " " " rock	at 4.00..	200,000
50,000 " " concrete	at 9.60..	480,000
Superstructure		70,000
Machinery equipment, etc.		100,000
		$1,000,000

Twenty per cent. of $1,000,000 is $200,000, which is the fee to the contractor. Saying that the actual cost on completion ran $1,400,000, there would be deducted from the fee, 10 per cent. of same, or $140,000, leaving $60,000 to the contractor. If the work cost $800,000, of which 10 per cent. would be $80,000, $80,000 would be deducted from the fee, leaving $120,000 to the contractor.

Important Combination of Two Large Engineering and Construction Companies

Of general interest is the combination recently announced of the organizations of Westinghouse, Church, Kerr & Co., Inc., engineers and contractors, New York, and Dwight P. Robinson & Co., Inc., constructing and consulting engineers, of New York. The new company will be called Dwight P. Robinson and Company, Inc.

Mr. Dwight P. Robinson, president of the new company, was for many years president of the Stone & Webster Engineering Corporation, and formed his own company in 1918. He has had a wide experience in the design and construction of industrial plants, large central power stations and hydro-electric plants, and his company, the principals of which left Stone & Webster with him, has specialized in work of this nature. At the time of the merger the Robinson Company had large power plants under construction for the Duquesne Light Co. at Pittsburgh, the Penn Public Service Co. at Johnstown, Pa., and others. Westinghouse, Church, Kerr & Co., Inc., established thirty-six years ago, has specialized in the design and construction of industrial plants of all kinds, railroad shops and terminals, and industrial power plants.

As the activities of the two companies were largely supplemental—each making its own specialized contribution to the new company—it is believed that the new organization will become one of the largest and most successful in the construction and engineering business.

The reason given for the merger is that the Westinghouse Electric & Manufacturing Co. is one of the largest stockholders of Westinghouse, Church, Kerr & Co., and the two companies have been closely identified for many years. To avoid therefore what has seemed a handicap in procuring business by the latter company, on account of the belief by prospective clients that if they employed it as their construction engineer, they might be expected to purchase Westinghouse Electric equipment, and also to permit the

Westinghouse Electric & Manufacturing Co. to withdraw from any interest in the engineering and construction business, that being a field foreign to its normal activities and its interest therein not being viewed with favor, by construction engineers competing with Westinghouse, Church, Kerr & Co., it was deemed in the interest of both companies that the above association should be terminated. The negotiations resulted in the plan of merger now declared operative, under which depositing stockholders will receive for their present holdings either cash or stock in the new company.

Contractor Uses Mail to Sell Services

Well-Prepared Letter Often Obtains the Desired Opening—The "Quality, Not Price" Idea Can Be Emphasized

SELLING services by mail is a scheme that can be applied to the contracting business as is proved by the success with which many firms carry on negotiations in that way. A well prepared letter may oftentimes carry a greater appeal to a man who wishes to build than a personal solicitation and the effort and expense is a great deal less. How one firm has obtained excellent results by correspondence is recorded in the February Contractor's Atlas, by Mr. Chas. F. Dingman, of the Flynt Building and Construction Co. We quote from his article as follows:

Under present day conditions the construction contract is not always awarded to the low bidder. Executives having charge of letting contracts have come to realize that there are more important factors of a contract than "price." They know from experience that many times the low bidder is the most poorly equipped for the work and the resulting construction proves very costly because of the inferior workmanship and materials which are ultimately discovered. To-day, the contractor is selling a service, and if he will bear this fact in mind, it will soon be found that his services can be sold on the basis of reliability and speed and that price is a secondary consideration.

In fact, under present conditions, it is not at all unusual for a construction company to absolutely refuse to bid upon what appears to be an attractive contract and which covers work ardently desired by them. Nor is it very unusual for one company to get work without bidding, even though competing organizations are willing to bid sharply for the same work.

The truth is that purchasers of the services of building and construction organizations, like the public in general, have been educated to the point where they realize that a low price may often result in getting less return for their money than a higher price.

Because this is the truth, builders have come to realize that the proper way to sell their services is on the basis of quality and service, rather than on the basis of price, and the purpose of this article is to show how the mails may be used to aid in selling service. Aside from the use of the mails as a means of carrying general advertising inserted in newspapers and periodicals, there are two classes of direct mail advertising, either or both of which may be made to pay handsomely when properly and diligently worked.

The first class or direct mail advertising is that directed to persons whom we have reason to believe are, or soon will be, in the market for building services and the second class is that addressed to comparatively large lists of persons for the purpose of building up a reputation that will produce results later on as well as for discovering possible immediate prospective clients. The present article will discuss more particularly the first class.

As soon as the construction reports announce that a person is about to build, that person usually finds himself deluged with circulars and advertising matter of all kinds of building materials. He finds that all of the time which he had hoped to devote to other things is taken up in interviewing, or refusing interviews to building contractors who want to put in a figure or building salesmen who want to be sure that their products are used in the building. Unless you are one of the first to see him, you find that he has begun to be so temperamental that it is difficult to conduct a pleasant interview with him. But—here is the point at which you can make the mails begin to work for you, don't go as an uninvited caller, but write the prospect a letter or letters that will make him want to see you and this is not so impossible as it may sound if you will only disregard the old cold and formal type of business letter and get right down to a man-to-man style.

Drawing the Client's Interest

To achieve this result your letter must open up with words that appeal to his own interest. Remember he is always thinking more about himself than he is about you or anyone else. Then let your letter tell him how his interests are going to be best conserved by employing you to do his work, tell him how pleased you will be to put at his disposal any facts or figures which your particular experience has enabled you to gather and which may be helpful to him in making up his program. Close the letter with a pleasant request that he invite you in to tell him just how you can serve him better than any of your competitors. If the first letter doesn't bring the invitation, send another and another until you get results or until the contract goes to some one else.

Now, I do not want to be understood as saying that letters should be used to the exclusion of other methods of soliciting business but I do want to say that they will, when properly used, save a great deal of time and expense that might be wasted otherwise, that they will often make it possible to secure interviews.

The citizens of Sherbrooke have passed a by-law authorizing the raising of $300,000 in connection with improvements at the Two Miles Falls hydro-electric plant owned by the city, also for $277,000 for waterworks improvements.

Concrete Block Plants and Equipment

Factors Governing Location and Operation Delineated in a Report of Committee of American Concrete Institute

THE most suitable location of any plant can only be determined after due consideration has been given to both the market in which the products will be sold and the availability of materials, the most weighty of which is the aggregate. When a plant is to have a comparatively large capacity it will usually be found economical to locate the plant near the source of the aggregate, when freight rates on finished product permit of such a location on an economical basis.

Materials

Availability of materials is based upon the assumption that materials are either locally available or that they may be shipped in by rail or other economical method of transportation. Where it is possible to locate a plant at the site of aggregate, rail haul on raw aggregate would of course be enlightened. The operator of the products plant, however, should compare freight charges on finished products for a plant located at the aggregate pit or other location, which makes the aggregate readily obtainable, with the cost of transporting raw materials to a plant near the centre of the market. It is usually not advisable to locate a concrete products plant midway between the source of raw materials and the centre of the selling market as the combined freight charges on raw materials and the finished products will probably be greater than where the plant is located at either the source of raw material or at the finished product market. When plants are located at midway points, double handling of cars is necessary, while at plants located at the site of aggregate, only the out-bound cars hauling finished products need be handled.

These suggestions are made without reference to freight on portland cement as this commodity constitutes only about 25 per cent. of the total tonnage. In summarizing, it may be stated that there are two logical sites for concrete products plants—one, near the source of raw materials—the other, near the centre of the market. In the manufacture of concrete products any location must be such that all factors including water, labor, fuel and incidentals are readily procurable.

Plant Layout

Ample space should be provided so that materials and products can be handled with ease and dispatch. The space should allow for expansion of the business to several times that originally established as often concrete products plants expand several times their original size. In general, a plant should consist of receiving facilities, manufacturing room, curing rooms, storage space and shipping facilities.

Receiving Facilities

Materials as used in the greatest volume, follow in their respective order, aggregate, cement, water, fuel and power. Aggregate may be received in some form of horse-drawn or motor-propelled truck, or even in cars or barges. Therefore, the method of unloading aggregate will depend upon the method of transportation. At the present time it is customary to dump truck loads of aggregate over a grizzly through which the aggregate will drop into a hopper feeding into a bucket elevator, which elevates the aggregate to bins, preferably placed overhead so that the material may be fed to the mixers by gravity or by conveyors. Where material is received in hopper-bottomed cars a receiving pit should be constructed under the railroad track so the cars may be unloaded by gravity. The pit may have the same type of bucket conveyor. If material is received in gondola cars it is customary to unload with shovels and to throw the material into the boots of the elevator or conveyor. This method is wasteful of labor and if the concrete products plant is sufficient in size the use of a power crane with a clam shell bucket enables material to be unloaded economically and quickly. The same crane may be used to build up storage piles of aggregate. These storage piles provide a reserve supply for winter work after pits are closed, or in case of a temporary emergency like a car shortage. Provision should be made for economical movement of this material from piles to the working bins.

Material Storage Space

Enough space should be provided for the storage of materials to keep the plant in operation over an estimated period of non-delivery of materials. This period will vary from, say a week in the open season, such as a delay caused by car shortage, or it may extend over several weeks or months during the winter season, when pits in many localities are closed.

Manufacturing Rooms

The plant should be designed in such a way that the least travel will be caused in handling raw materials and finished products. In general, raw materials should be received either at one end or side of the plant and travel in the shortest direct line from the storage bins, through mixers, machines, curing rooms, storage yards and thence to cars or trucks for delivery. Machines should be placed in such relation to each other that materials may be conveyed from the storage bins to the mixer with the least labor and by the simplest system of handling practicable.

Finished Products

Ordinarily the delivery of materials to the mixer is either by gravity or with mechanical equipment. Concrete may preferably be delivered by gravity or mechanical means to the molding machines. Finished products should be delivered to storage rooms by one of two preferable methods, namely, racks which may be handled by jack-lift trucks or industrial cars on narrow gauge tracks. Any other mechanical method of handling which may be on the market now or which may later be placed on the market should be considered on its merits and compared with the two methods herein suggested. Cured products should be conveyed from curing rooms to the storage yards or storage rooms by one of the methods suggested above for handling fresh products.

Curing

The method of curing shall be such as to produce proper hydration of the cement content.

Machinery and Placement

Machinery will consist of conveyors, concrete mixers, concrete products machines, boilers, power units such as gas engines, steam engines, electric motors, industrial cars, racks and jack lift trucks. Elimination of belting and shafting is advisable and the use of individual motor drives is to be recommended. This will promote safe plant operation. It will also lessen the possibility of a total shut down, such as would be caused by the breaking of a main belt or a main shaft. Motors should be placed in the safest and most practicable location. When bought attached to the machines the manufacturers, in most cases, will have the motors properly located.

Concrete Mixers

Concrete mixers should have ample capacity to provide concrete for all of the product machines. It is recommended that mixers be placed above the products machine so the concrete can be delivered by gravity. Products machines should be of good type and suitable to the requirements of the business. They should be placed on substantial concrete foundations, as the use of such foundations result in smoother operation and longer life of equipment. In the use of industrial cars, track should be carefully laid true to line and grade. Where racks and jack-lift trucks are used smooth level concrete floors should be provided in machine rooms and curing rooms and concrete runways should be provided in the storage yard.

Conveying Machinery

Where possible, it will be advisable to obtain conveying machinery from manufacturers of established reputation who will furnish and install such equipment.

Where steam curing is used boilers should be of such size and type as will furnish the required amount of steam without overloading. The steam capacity should be sufficient to cure the products and heat the building. The size of the boiler will vary with the size, number and type of construction. It is recommended that a small curing room be provided for concrete trim or special units. In general, this committee recommends that it is advisable to obtain the services of competent engineers to design and supervise the layout of concrete products plants.

How Should Expense of Estimating be Borne?

Present Methods of Duplication of Effort Involve Tremendous Waste—Quantity Survey Should be Furnished by Owner

By Henry K. Holsman*

ARCHITECTS have realized for a long time, I think I can say without hesitation, that there is a tremendous amount of waste in the present method of making up estimates. The burden is said to be borne by the contractors, but as a matter of fact the contractors as a whole must pass it on to the community, and the architect is justified in co-operating with you to eliminate that waste as soon as possible, on the ground that it would eliminate an unnecessary charge against the community. When the architect fails to take off the quantities for a job before giving out the plans to ten different contractors and asking for bids, the estimating that must be done on that one job is ten times more estimating than would have been necessary, so far as quantity is concerned, if the architect had given the contractors a survey of the materials that would be required to be left in place in the building when the building is finished.

Now, the cost of estimating, or expense of estimating, in our judgment cannot be entirely eliminated from the contractors' expense. The cost of selling your product, your experience, your ability, must be borne by your trade much the same in contracting as in selling any article of merchandise.

The situation of the buyer in the building field may be summed up as follows. Presumably the owner has gone to the architect and has had the architect map out the plans and specifications for approximately the kinds of material he wants to get. He then hands these plans and specifications to the contractor for his experience in estimating and for putting together a structure so that it can be used efficiently. In that case the owner has set down the kinds of materials that he wants, and has presumably paid for that much of the cost of selling as distinguished from the prices ordinarily employed in the commercial world.

But he still falls a little short in our estimation. He gives the contractor plans and specifications laid out in the general way, but he might have gone into the estimating end of the matter and given the general contractor a quantity survey of the plans and specifications, which would make it much easier and less hazardous.

Conclusions of Joint Conference

It is with that thought that the Joint Conference on Payment for Estimating Construction Work, which is composed of a committee of your organization, one from the American Institute of Architects, and one from Engineering Council, formulated the resolutions that I shall now take up. Two meetings were held by the Conference, at which the subject of the expense of estimating was discussed at great length. The resolutions adopted are as follows:

> Whereas, there is a great economic waste in the present usual methods of individual estimating of the same quantities by several different bidders on the same project; therefore
>
> Be it resolved, that the following are the conclusions of this conference:
>
> First, That any system of duplication of effort in estimating, wherein each bidder separately estimates the quantities, should be condemned.

There are many reasons why such methods of estimating should be condemned. But what comes to my mind just now as most important is that the largest part of the great variation in bids often found on a structure is not due to the difference in prices that contractors place on materials, but instead is due to the variation in the estimates of the quantity of material and labor that would be necessary to carry out those plans and specifications. The commonest complaint is: "Well, I got that contract because I made a mistake—I left out one floor." That alone is enough to show that the system should be condemned—that it is an economic waste.

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*Before National Conference on Construction of the Associated General Contractors.

Then, if there is an average of ten bidders on one job, or if every contractor on the average must bid on ten jobs to get one, manifestly there is ten times as much effort expended as is necessary. It is also manifest from our point of view that if the quantities for the job were taken off in a sympathetic manner that would be by necessity universally adopted by the contractors, and if the quantities were taken off under the supervision of the architect who makes the tracings and the specifications, the quantities then would be more apt to correspond with what is expected by the architect than if they were taken up by some individual who never saw the tracing and specifications before.

If it is specified that all shall bid on this bill of quantities, or on this quantity survey and none other, they all have at least one common thing fixed. Under the present method, each bidder may submit a proposal on a different schedule, based upon the way in which his estimates have interpreted the plans and specifications, and upon the care taken to include everything called for.

Recommend Furnishing Schedule of Quantities

The second section of the resolutions is as follows:

> All competitive bids should be based upon a detailed schedule of quantities prepared from a survey of the plans and specifications, and submitted therewith, the costs of the preparation of such survey of quantities to be borne by the owner.

The only comment that I have to make on this is that we all agree that if the buyer, the owner, is going to go to the trouble of having the plans and specifications prepared, it is logical that he should go further and get a comprehensive estimate for the bill of material or quantity survey that could be easily priced.

No Additional Payment

The third part of the resolution bears upon payment for pricing the work:

> While the owner should furnish a quantity survey as the basis of bids and contracts, and should submit them with the plans and specifications, and should pay for the same amounts to the bidder, the bidder should make no charge to the owner for submitting proposals based on said plans, specifications and quantity survey.

While the owner should furnish a quantity survey as a basis of bids to contractors, we do not feel that, in addition to this, he should pay each contractor for pricing the quantities and for the various items of overhead that bidding on projects entails.

There is undoubtedly an economic gain resulting from the preparation of a quantity survey by only one individual or institution instead of by five or ten as the case may be, provided these quantities are guaranteed to be correct enough for bidding purposes. Even if the quantity survey says that there is less material required by the plans and specifications than will be necessary, so long as it affords an equitable basis for bidding, it has served its purpose in a large measure. Adjustment of the contract price may be made to correspond to actual conditions, either before the contract is signed or as the work proceeds.

But when the owner and buyer has gone that far, he says, "This will do for the basis of bidding; here is something that you can give us your prices on. But we feel we ought not to go further as buyer, and so we will not pay you for putting prices on these quantities."

In other words, if we were attempting to say that the owner should pay a contractor for his trouble in figuring up his prices and bidding, we would be going too far. The accepted principle in commercialism is that the cost of selling a product be added to the price charged the buyer, but only in case he does actually buy. Our first step is to say, then, that bidders should make no charge to the owner for submitting prices on his building project, provided the quantities are furnished.

Without Quantities, Pay Each Bidder

In the last section of the resolutions, an alternative is proposed whereby each contractor would receive pay for his estimate if he had to prepare his own quantities.

> In general, competitive bids should not be invited nor submitted on projects, the plans and specifications for which are not accompanied by a quantity survey, unless the owner agrees to pay a predetermined fee to each bidder for preparing the quantities and submitting an estimate

This clause, I think, was finally determined upon as a suggestion of co-operation between the builders and architects by way of helping to get the thing established.

Now, you see, if we could agree upon these principles, and have it recognized that they are just and fair to the contractor and the architect, and have them widely known, we could accustom those interested to the idea that unless the plans and specifications are complete, and include a quantity survey, they are not yet ready for bids. This would mean a long step towards reducing some of the errors in bidding and the estimating expense under the present method of bidding.

Lightning Rod Dealers Meet

A convention of lightning rod dealers was held on April 1 and 2, at Guelph, Ont., the sponsors being the Shinn Manufacturing Co. of Canada, Limited. A program was arranged with a view to enlightening the dealers on the merits of lightning prevention equipment and the methods of installation. Some of the addresses which were given at the convention were: "The Science of Lightning Rods, with Demonstration on Static Machine" by W. H. Day, Manager Shinn Mfg. Co. of Canada; "What Constitutes a Good Lightning Rod" by W. C. Blackwood, Professor of Physics, Ontario Agricultural College; "Some Cases of Improper Rodding" by R. R. Graham, lecturer in Physics, Ontario Agricultural College; "How Dealer Can Best Utilize Assistance of the Shinn Traveller" by J. D. Lang; "System of Rodding for Different Types of Buildings and How to Install Shinn-Flat" by W. H. Day; "The Fire Marshal's Office and Lightning Rods" by E. P. Heaton, Ontario Fire Marshal.

New Fair Wage Schedule Adopted For Montreal Contracts

THE Administrative Commissioners of Montreal have approved of a revised fair wage schedule which will be inserted in all contracts to be carried out for the city. This schedule is the minimum wage to be paid. The rates paid the laborers and carters permanently employed are lower than those inserted in the fair wage schedule, and this was done owing to the fact that the city laborers and carriers have more or less permanent employment, while those engaged by contractors do not get such steady work. Following are the rates for 1920 as compared with those for 1919:

	1920	1919
Bricklayers	75c	60c
Bricklayers (sewers)	85	70
Carpenters & Joiners (not including mill men)	55—67½	45—60
Cement finishers	60	40—60
Electricians	50—75	40—50
Engineers (miners)	50	40
Engineers (stationary)	50	40
Laborers (common)	40	30
Laborers (hodcarriers, etc., 9-10 hrs.)	45	35
Blacksmiths	55	45
Pavers	55	48
Block setters	55	
Curb & flag setters	55	45
Weighers	35—45	35
Asphalters (finishers)	50	45
Asphalters (rakers)	55	50
Polishers	60	40
Levellers (cement)	45	35
Rollers (asphalt)	50	35
Big Roller (macadam)	45	40
Bottom men (drains)	40	35
Carters (single)	5.00	4.00
Carters (double)	8.50	7.50
Masons	75	45—55
Plasterers	75	50
Painters	75	40—45
Plumbers	75	45—55
Tile setters	70	45—55
Sheet and metal workers & roofers	70	40—45
Steam fitters	75	45—55
Stone cutters	75	50

Plumbers Air Troubles at Meeting of Master Plumbers' Association

THERE was plain speaking at a meeting of the Montreal Master Plumbers' Association, held to consider the conditions existing between the manufacturers of plumbers' supplies, such as boilers and radiators, and the master plumbers. Protest was made in regard to the expense plumbers are put to for labor in replacing defective material supplied to the trade by the jobbers. It was stated that a joint letter sent to the manufacturers, of which there are only six in Canada, suggesting that a conference be held to discuss the situation, had elicited no reply at all, or else responses to the effect that the time was not opportune for such a meeting; only one firm had shown any desire to deal with the situation.

A third trouble brought up was the fact that manufacturers allow discounts to anyone instead of only to those in the trade, and that they sell direct to contractors, builders, journeymen plumbers, and, in fact, to anyone who will buy from them.

Exception was also voiced to journeymen plumbers being able to obtain master plumbers' licenses, the statement being made that at present there are as many journeymen plumbers holding licenses as there are bona fide master plumbers. Other subjects taken up were the standardization of charges for labor for repair work, the labor situation in general, and the extension of membership in the association. The entire questions were referred to the Association.

Financial Authority Claims Building Movement Will Grow Slowly

PRESENT conditions indicate that a large building movement which now seems inevitable in view of the housing shortage must be of slow and gradual growth, the National Bank of Commerce in New York declares in the April number of its magazine, Commerce Monthly.

"The dearth of building supplies," the bank continues, "is rendered more acute by difficulties of transportation. Some time must elapse before the various lines of industry which furnish these materials will be able to function at full capacity. Added to this is the difficulty, under present conditions, of financing new enterprises."

In summarizing the current market situation, the bank says:

"Fundamental business conditions have changed little from a month ago. The present price level requires a large volume of credit and capital for essential transactions. This, coupled with the fact that sound public policy requires a conservative use of bank credit, has resulted in an increasingly cautious attitude on the part of industry and commerce. Such an attitude is much to be commended. If it is reflected in a correspondingly conservative attitude on the part of the consumer and in earnest effort on the part of the producer, it may enable credit contraction to be effected without loss or shock until a normal basis is reached.

"Industry continues to be hampered by inefficient transportation. This is not a condition which can be materially aided by redistribution of cars but can be remedied only by the purchase of a large amount of new equipment and the heavy repairing of old. Although a number of railroads are now in the market for rails, cars and locomotives, the buying movement has not yet reached large proportions. Extensive purchases on the part of the roads must wait the making of adequate financial plans. Some needs, however, such as the requirements of the repair shops, are so urgent that buying of this kind cannot long be postponed."

Construction in Montreal continues to improve. Every month of the first quarter of the year has shown a substantial increase over that of the corresponding period. In March, the total amounted to $847,247, as against $228,208 in the corresponding period in 1919. The total for the first quarter of the year amounts to $1,461,237, which compares with $440,102 in the first three months of 1919. The reports from the architects and contractors are very optimistic, and the outlook for the 1920 building season is that it will be one of the best on record.

Contracts Which Disregard the Square Deal

Many Clauses in Specifications are Unfair to Contractors—Stipulations May be Modified Without Injury to Interests Concerned

MAJOR requirements which are common to specifications for engineering construction and which are eminently unfair to contractors are: (1) Reservation of the privilege of changing plans without invalidating the prices bid or relieving the contractor from obligation to complete the work; (2) stipulation that instructions by the engineer must be obeyed, that his decision is final and that the progress and sequence of construction shall be as he directs; (3) provision that inconvenience or delay due to any cause shall not entitle the contractor to damages or extra compensation.

Exactly how these stipulations operate unfairly and the size of the penalty which they sometimes impose are facts which are not well understood. To clarify this understanding it is undertaken in this article by F. J. Herlihy, of Winston Brothers Co., Minneapolis, Minn., in Engineering News-Record, (1) to explain the fundamentals of estimating sufficiently to show the exercise of the privileges enumerated may invalidate an estimate; (2) to illustrate by actual example how changes in plans have changed the cost of construction; (3) to indicate in what manner these stipulations may be modified so as to eliminate their vicious character wthout injury to any of the interests concerned.

Fundamentals of Cost Estimates

As a hypothetical example an ordinary unit-price contract is assumed. The payment quantities consist of only the major items of work, such as earth and rock excavation and concrete masonry. A simple unit price is asked per cubic yard for each of these items, and this price includes all expenses incurred either directly or indirectly in the execution of the work.

To determine the method of attack and the size and kind of plant and organization required it is necessary to know: The volumes of the different classes of work; the balance between the expensive and inexpensive items; the availability of materials; the climatic conditions; the time allowed to perform the work; the date of effective possession of the site; the promptness with which plans and instructions may be expected; the wages and the supply of labor; the possibilities of contracting for materials ahead of construction; the volume of non-revenue-producing work which must be pro-rated against the revenue-producing items, and the sequence of construction.

Brief consideration discloses why this information is necessary and should be, as far as is possible, accurate and definite. Construction to be performed economically must be begun at the proper point and proceed connectedly to a fixed objective. False moves are expensive. All operations must be concurrent and in logical sequence. Plant and organization must always be the minimum consistent with economical production and with the completion of the construction on time. They have to be planned so that they are available as needed for the different classes of work, and so balanced that the individual classes are prosecuted in such order that as much of the whole work as is practicable may be executed at the same time, and that all equipment and men are kept busy from the time they are placed at work until they are finally laid off.

Analysis of Expenses

Construction costs are general or indirect and specific or direct. Indirect expenses, which must be prorated against the revenue-producing items, subdivide into overhead, installation and dismantling, and miscellaneous work. Direct expenses, which can be charged against the revenue-producing items, include plant rental, permanent materials and operating expenses.

It is important to have clearly in mind the nature of indirect expenses. Overhead charges are interest on the investment, liability insurance, superintendence, hire of clerks and watchmen, field and general office expenses, railway fares and incidentals. Installation and dismantling charges are all expenses incidental to installing plant and construction facilities in working condition and the dismantling and storing or shipping of this equipment when the work is completed. Miscellaneous charges include drainage, maintenance of public utilities and other expenses not chargeable to definite items.

Observe that all of the charges which made up indirect expenses are either fixed quantities or their amounts depend upon time. Any changes in the payment quantities of the various classes of work on which these charges are based, will affect their unit cost to the work and consequently produce conditions different from those anticipated at the outset and make the value of the contract work different from that intended by the original agreement.

Plant rental and operating expenses are particularly affected by change of plans, delays, etc. Whether rental charges are made directly against individual classes of work or are pro-rated, it is obvious that they will be a fixed quantity per day and any variation in the daily output will affect the unit plant rental charge to the work. If the work is delayed for any reason and the plant stands idle the daily costs will accrue and no extension of time nor any other concession, except to pay the contractor at the rental value for the equipment, will compensate him for the loss.

Operating expenses include all charges for labor and material, and supplies (explosives, fuel, etc.) and the freight charges thereon, incurred in excavating rock and earth and in constructing concrete masonry. The bulk of this expense, except explosives, will be a fixed quantity per unit of time. Therefore, any change in the periodical output of work will affect the unit charges against the work.

As average unit prices are asked for earth and rock excavation and concrete masonry, the price bid is based on the average value between the expensive and inexpensive elements of the different classes of work. Should the balance between this profitable and unprotable work be distributed, it is bound to affect this average value. In case the work is delayed the cost will not only be increased by the expense of holding the necessary nucleus of an organization under pay, but it will be still further increased by the reduced efficiency of a new organization, which will require some time to train. Should the sequence of the work be changed and the work prosecuted piecemeal instead of in economical sequence, both the plant rental and the operating charges will be affected, as false moves of plant and organization will then be necessary, and they are expensive.

Permanent material charges should not vary unless the work is so delayed that material dealers withdraw their protected prices, or unless the sequence of the work is such as to make the requirements spasmodic and beyond storage facilities or the output of the dealers who have contracted to fill the requirements, and force the contractor into the open market to procure the extra material required to keep going.

Example of Altered Costs

Changes which can be brought about in the cost of construction by changing plans are clearly indicated by an actual occurrence in the writer's experience. The work was the widening of a canal. It called for the removal of a strip on each side by steam shovels and the excavation of a trench by hand in the remaining ledge for the foundation of a concrete wall. Average unit prices were called for, a single price per cubic yard being bid for rock work. The engineer, after altering the characteristics of the work to the extent indicated in Table I, ruled that the contractor must perform the work at the prices bid originally. The work was performed under protest and a claim for extra pay was submitted to arbitration. The decision was against the contractor.

By reference to Table I it will be seen that the engineer changed the character of the work by decreasing the inexpensive quantities and increasing the expensive quantities.

In the stipulation defining changes in plans, the wording should be so amended that, while it still gives the proprietor, or his engineer, the right to make any changes he sees fit, if by the changes the characteristics of the work or the conditions governing its execution are changed to the extent of changing the value of the work, provision is made to change the contract price accordingly.

Provision should also be made in this stipulation to protect both parties when changes are made in the unit quantities. This can be done by bidding a lump sum for the work, based on the unit quantities scheduled in the call for bids, which quantities should be guaranteed by the proprietor and stating also a unit price for each item, this unit price to be used only in adding to or deducting from the lump sum bid, when changes in the quantities are made. In making up his bid under this arrangement, the contractor can make his lump sum to cover all costs and profits, including overhead and indirect charges based on the guaranteed quantities scheduled, and he will include in his unit prices only such charges and profits as are directly affected by the direct expenses. In this way the contractor will be sure of his general expenses and profits on the work actually done, no matter how much the quantities are reduced, and the proprietor will benefit, in case quantities are increased, by paying only the cost and profit for the extra work done. It is, of course, understood that this arrangement would only apply insofar as increases in qualities are concerned when the increase would not entail the bringing on of extra equipment to do the extra work, but that the increased work can be done with the equipment already on hand, by granting an extension of time or working extra time, such as double shift, or otherwise.

In contracts where unit prices are stated, either one party or the other must suffer when quantities are changed. When the quantities on which the bids are based are reduced, the contractor will suffer to the extent of the overhead and other indirect expenses which he has charged against the work that has been eliminated, and if the payment quantities are increased, the proprietor will lose by having to pay for the increase at the same unit price as for the original contemplated quantities, against which latter the entire overhead and other indirect expenses are charged. As to the proprietor guaranteeing quantities, this is as it should be. This burden should not be placed upon the contractor, who has neither the time nor anything like the facilities which the engineer has for ascertaining this element of the contract.

The stipulation making the signed order of the engineer acknowledging claims for extra work a condition precedent to the contractor's making claim or receiving compensation for extra work should be stricken from all contracts because it is manifestly unjust.

This stipulation clothes the engineer with autocratic authority, which he does not need to maintain the rights of either party, and which can only be useful to an official who wishes to invade the rights of the other party and impose upon him conditions that were not intended by the original agreement. If the engineer assumes a position on any matter that is consistent with the intent of the contract, his interpretation will prevail without the aid of this stipulation, but if his position is not consistent with the original agreement, he should be overruled.

The engineer should have the power to order performed any work that is necessary and the proprietor should be protected against imposition by having these

Table I. Comparison Between Cost Estimated on Original Quantities and Actual Costs Incurred by Changed Quantities

A—According to contract and specifications:		
Machine work, 430,380 cu.yd. at $0.611		$262,962.18
Hand work, 5,800 cu. yd. at $3,611..		20,943.80
Total		$283,905.58
Cost cu. yd., $283,905.98÷436,180		.651
B—Cost of work actually done under altered conditions on above basis:		
Ordinary machine work, 268,168 cu.yd. at $0.611..		$163,850.65
Expensive deepening, 13,200 cu. yd. at $1.469..	$19,390.80	
Hand work—ledge excavation, 34,500 cu.yd. at $3.611...:...	124,579.50	
Hand work—foundation excavation, 5,832 cu.yd. at $3.611	21,059.35	
Hand work—miscellaneous excavation, 709 cu.yd. at $3.611..	2,560.20	
		167,589.85
Total..		$331,440.50
Cost cu. yd. $331,440.50÷322,409		1.028
Cost cu. yd. as per contract ..		.651
Balance or loss per cu. yd.		$0.377
Total loss to contractor =322,409×$0.377		$121,548.19

orders written, but if that work is extra work, not contemplated under the true interpretation of the contract, the proprietor should pay for it. The engineer should also be master of the situation insofar as the interest of the work is concerned, but all differences of opinion as to the interpretation of the contract, regarding claims which either party may have, which have not been adjusted at the time, should be submitted to arbitration at the close of the enterprise. There should be a stipulation in every contract whereby either party will have the right to have its differences arbitrated at the conclusion of the contract, and neither party to the contract should be its final arbiter.

A stipulation which gives the engineer the power to direct the sequence of the work should be eliminated from all contracts, except those in which the required sequence is clearly disclosed by the information given to the bidder at the outset.

Any change in the sequence of the work is bound to affect its value adversely to the contractor, as he will have chosen the most economical sequence in organizing the work. If the engineer has some particular sequence in mind, there is no reason why this information should not be disclosed beforehand, unless it is that he is uncertain of his ability to deliver the site, plans, etc., on time, in which case the risk should be with the one who controls the situation and not with the contractor.

The stipulation headed "inconvenience or delay" should be amended to place the whole responsibility for delays on the party who causes them.

The contractor should not be made to suffer the monetary loss incurred in holding plant and organization idle through the fault of the proprietor. He does more than his share when he assumes the monetary loss due to delays caused by climatic conditions, actions of the elements, labor and material troubles, and his own errors of judgment. As before stated, neither an extension of time nor any concession, except monetary compensation, will compensate the contractor for delays.

Britain Adopting this Continent's Excavating Methods

THE accompanying illustration shows the first steam shovel ever used for building construction work in England—a Type "B" Erie. This shovel is owned by F. D. Huntingdon, Ltd., engineers & contractors, 11 Hanover Square, London. The shovel is excavating for a chewing gum factory to be occupied by Adam & Beemans, Ltd., the British branch of the American Chicle Company. Because of the comparatively small amount of material to be handled the contractors thought at first the use of a steam shovel was hardly warranted, but they were delighted with the results, both from the point of view of the speed with which the work was handled and the clean job done by the machine.

The output on this job was limited by the rate at which carts could be brought into position, and was far below the shovel's capacity. Even with this hindrance to contend with, F. D. Huntingdon, managing director of Huntingdon, Ltd., writes that "This shovel has proved of inestimable value, cutting our excavation cost in half."

There are twenty of these shovels, built by the Ball Engine Co., being used by British contractors and manufacturers, and more are on their way. These Erie shovels are doing the work in far less time than would be required by hand labor, at about one-third the cost.

Steam shovels are not a new thing in England, but the British steam shovel is a heavy and cumbersome machine and is only suitable for the heaviest kind of digging. English labor conditions, in the past, have not warranted extensive use of excavating equipment. Manual labor has been cheap, and often more profitable than the heavy steam "navvies" as they are called. Then too, the amount of excavating on most contracts has not been so large as to warrant the use of such heavy and expensive machinery. A light 20-ton or 14-ton shovel, capable of traveling anywhere under its own power, has been absolutely unknown in the past. However, recent developments in the labor conditions—the shortage of manual labor and the increase of wages—have prepared the market for an easily handled, and reliable steam shovel such as the one illustrated.

The first revolving steam shovel in England excavating the first cellar ever dug by steam shovel

Port of St. Pierre to be Developed

The French consul at St. John, N. B., has received notification from an engineer, representing the French Government, that the port of St. Pierre, Miquelon, is to be developed. It says the French Government has authorized the engineer to construct two breakwaters, altogether about 3,600 feet long, with a depth of 20 feet as the maximum over the lowest tide, and requiring about 200,000 yards of masonry, about 50,000 cubic yards of sand and gravel and about 1,000 cubic yards of rock will have to be removed. The French Department of Public Works, it is said, will also equip the harbor with a modern lighthouse, sirens, buoys, etc. Hundreds of vessels go out yearly from ports of France to engage in the bank fisheries, and the port of St. Pierre is the central depot and harbor of refuge. Canadian contractors have been invited to tender for the work.

Slate Products Co.

With a capital of $200,000, the Slate Products Company of Canada, Limited, Montreal, has been formed to carry on the business of quarrying, manufacturing and dealing in slate, stone, lime, cement, brick, gravel, etc.

Field Practice on Monolithic Concrete Houses

Report Presented at National Conference on Concrete House Construction Outlines Practicable Erection Methods

The total amount of concrete required for a concrete house is relatively small and does not justify heavy and elaborate equipment. Large capacity mixers and spouting from a high tower have not proven successful. A small one-bag batch mixer will mix the concrete in sufficient quantity and sufficiently rapidly and where construction is on a large scale with many houses going up at once, several small mixers are needed rather than one or a few large ones. For the construction of two-storey houses, some separate means of elevating the concrete is necessary, unless elevating machinery is a part of the mixer outfit such as the Humphrey conveyor equipment. George E. Lewis of the Marion Double Wall Co., Marion, Ohio, who has had a great deal of experience in constructing Van Guilder houses, has solved the elevating problem as required by the Van Guilder wall machines by using a small lift which carries a flat platform wheel barrow loaded with pails full of concrete. This is the quickest, easiest and most economical way of handling the materials. A pail full is just the right amount to be tamped into place at a time and a good operator can tamp as fast as an assistant can throw it into the forms. The pails are easily wheeled to place and by using a system of inexpensive, collapsible scaffold horses to carry the plank runways, they can be kept within easy reach of the forms with but very little effort.

Portable Lift for Raising Materials

They use a small portable lift which consists only of two guides built up in interchangeable sections and bolted together. These are held in position by staying to the different floors as the work progresses. Where it is impossible to put the lift inside of the building they have used it outside without using but few extra stays. The platform of the lift itself is about 2 feet, 6 inches by 3 feet, 6 inches, just large enough to carry a wheelbarrow but not so large that it will be too heavy for the power plant. They use a Jaeger mixer with 3½ or 5½ h.p. engine either of which is sufficiently strong to operate the lift and mix a batch at the same time.

The mixer should have a hoisting drum attached to operate the lift and should be sufficiently open to be easily cleansed. The hoisting attachment is usually added to standard mixers as a special appliance.

Construction of the one hundred concrete houses at Donora, Pa., was started with a high tower, but the tower was dispensed with later and small mixers and hoists substituted with better results. A small Koehring Mobile mixer was placed alongside each house during concreting. The concrete was handled in buggies, lifted by Saegen circle swing derricks.

Five Houses Poured From One Set-Up of Plant

Houses consisting of reinforced concrete foundations and walls with a brick veneer were constructed in groups of ten by Daniel Crawford, Jr., at Long Island, N. Y. The equipment used consisted of a one-bag capacity side loader mixer, a 7 horse power kerosene hoist and an Insley Mast Hoist Bucket Plant, this equipment being placed on the street in the centre of a group of ten houses so that five houses were poured without moving any chutes. After five houses were poured the chutes would be swung around to pour the remaining five so that from one set-up of the plant the entire ten were sufficiently covered.

A 50-foot mast was used, this being framed by carpenters on the job, the mast being hollow and framed out of 2 inch stuff to the dimensions shown in the detail drawing, which were furnished with the bucket. In erecting this mast a light gin pole about 35 feet long and 6 inches in diameter was first put up, then the mast for the bucket was rigged up to the gin pole and set up and the four supporting guys made fast. The cable for the bucket hoist line was reeved up before the mast was set in place and the lifting was done by the hoist that was afterwards to be used to elevate the bucket, and in dismantling. The frame supporting the chutes was then clamped fast near the top of the mast and the plant was ready for operation as soon as the chutes were hung in place. The plant handled about seventy yards per day with a crew which consisted of one foreman, three men wheeling aggregate, one man handling cement and water, one hoisting engineer and three men tamping and handling chutes.

In constructing the Van Guilder houses at Youngstown, Ohio, a ¼ yard Jaeger mixer was used and the material conveyed in buckets on platform wheelbarrows operated on runways up to the second floor level. The buckets were passed up by hand for the second storey walls. The crew consisted of eight men up to the second floor, and nine men for the second storey.

Surface Finish

It is usually assumed that the exterior walls of monolithic concrete houses cast in forms require some treatment to make them attractive. It is not within the province or this committee to say what color, combination of color, or light and shadow is best suited to the exterior of houses. A wide variety of color, light and shadow, however, is obtainable with concrete, and final decision as to finish must be made to conform to local conditions and especially to the grade or class of the houses.

There are two general ways of obtaining surface finish, (a) application of coloring to the concrete surface after the forms are removed and (b) treatment of the surface itself either before or after the forms are removed. Color may be applied directly to the concrete surface either as stucco or paint. Stucco may be had in any conceivable shade of color and a considerable range of choice is also afforded by special paints suitable to concrete surfaces. A machine for applying stucco, known as Hodges stucco machine, has lately gained considerable attention. Saving the expense of painting has been given as one of the advantages of concrete houses. Stucco, applied directly to the concrete surface without the use of lath or fabric of any sort will be absolutely permanent if the work is properly done, and freshening of the surface to restore the color which may be done by the simple process of washing with a hose and scrubbing.

Surface finish obtained by depositing colored aggregate or coloring material in the forms next to the surface or by mechanical means, such as tooling, sand blasting, etc., or a combination of these will usually cost less than stuccoing and will produce an absolutely permanent finish. The variety of color effects is however, much more limited than is obtainable with stucco.

Interior Construction and Inside Finish

The truth is outstanding and should not be lost sight of that the monolithic concrete house in which concrete has been consistently used in walls, floors, partitions and roof **does** represent the highest type of firesafe, permanent, maintenance-free house.

It is universally admitted that concrete floors are fireproof and sanitary. There is, however, a marked difference of opinion as to the desirability of a concrete floor surface from the standpoint of comfort and coziness.

Wooden floor surfaces are applied either by embedding nailing strips in the concrete or by covering the structural concrete floor with "Nailcrete" or a mixture of cement mortar and cardust or cinders. The best solution of the concrete floor problem is the use of easily removable floor coverings of carpets, rugs, linoleum or patented floor coverings. Inserts for buttoning down floor covering may be embodied in the concrete. The covering is easily removed and the floors may be flushed and scrubbed.

Solid monolithic concrete walls are no exception to other masonry walls in regard to the requirement for insulation to prevent condensation of moisture on their interior surface. Furring, lath and plaster should be used producing an air space between the concrete wall and the surface of the interior finish. For this purpose wooden nailing strips or plugs to which the furring may be attached should be embedded in the concrete wall or wires, or "hairpins" allowed to protrude from the concrete for the attachment of ribbed metal fabric or wire mesh. Whatever detail is adopted, the fundamental requirement of insulation must be provided, and either a "dead" air space must be obtained or some insulating material such as linofelt, cabot's quilt, corkboard, etc., used between the concrete and the inside finish.

Partitions

Partitions in a thoroughly fireproof house should also be fireproof. In monolithic houses of the bearing wall type with concrete floors it is usually economical to make some of the partitions heavy enough to carry the floor loads, thus cutting down the floor spans and obviating the use of columns or deep beams. These partitions are then similar in construction to the exterior walls and are fireproof. Furring is omitted and the finish applied directly to the concrete surface. Partitions that do not carry floor loads may be constructed by plastering and back-plastering on ribbed expanded metal or mesh. Openings in such partitions may be secured by using pressed steel or concrete studs each side of opening. Plastered partitions may be made to form a deal air space by constructing two walls a few inches apart, both plastered on expanded metal or mesh reinforcement.

In order to carry out the idea of firesafeness completely the roof must be incombustible. If the ceiling of the top floor is concrete and the roof covering is tile, slate or asbestos shingles, the roof framing may be of wood without appreciable increase of fire hazard. If there is no means of communication between the upper rooms and garret, a wooden frame roof, and the top floor concrete ceiling constitute in reality two roofs and the extra expense can be justified only because of architectural effect and some additional protection from heat and cold. The concrete ceiling may serve at the same time as a roof. This brings us to the question of the flat roof and its appearance. Much difference of opinion exists in regard to this matter. It is certainly true that many high class residences have flat roofs. Both flat and pitched roofed houses were constructed in the Cranwood development, and the flat roof houses were the first choice of the purchasers. A concrete roof built with forms is more difficult to construct than a flat one. A concrete pitched roof can, however, be constructed by plastering or shooting with a cement gun on expanded metal or mesh reinforcement.

Conclusions

(1)—Concrete, being a different material than other materials used in home building, presents new problems and new limitations in design. These must be studied in order to produce artistic effects economically.

(2)—When houses are built in groups having the same overall dimensions, good architectural design can be given sufficient variety to remove appearance of sameness by using colors, by methods of surface finish and by skillful arrangement of roof balustrades, cornices, porches, etc. Irregularity of design, bay windows, curved surfaces, cornices or oblique angles are not necessary to good appearance of a large group of houses.

(3)—The thickness of walls of monolithic houses is governed by considerations of field practice rather than by the requirement for strength. Building regulations should recognize the greater strength of concrete and therefore the thickness of walls should be governed by the requirements of standard engineering practice. The exterior bearing walls built solid, the thickness in the basement need not exceed 3 in. and in first and second stories 6 in. Where hollow wall construction is used the same total thickness of concrete is sufficient. For exterior partitions 4 inches is recommended.

(4)—Well constructed 6 inch concrete walls require little reinforcement for structural reasons, but do not need more than ¼ of 1 per cent. to provide for temperature stresses. A proper mix for these walls is about 1:2½:4, with maximum size aggregate about 1 inch. Broken stone, pebbles or a good grade of slag or cinders may be used as coarse aggregate.

(5)—In climates subject to sudden and great changes of temperature, a dead air space throughout the exterior walls must be included within the wall proper or an air space must be formed by furring and plaster or some insulating medium used between the solid walls and the interior finish.

(6)—Complete firesafeness requires concrete floors and partitions and an incombustible roof.

(7)—If a concrete floor is finished in cement it should preferably be covered by rugs, carpets, linoleums or special floor coverings that are easily removed.

(8)—A thin stucco coat has been found a satisfactory method of finishing exterior surfaces. Finishes have also been obtained by exposing colored aggregates and by tooling, sand blasting or rubbing, in some cases with success. Trowelled finishes are not recommended.

(9)—Small, one-bag batch mixers and simple elevating equipment of the mast and bucket or two-legged tower and skip type are best adapted to monolithic house construction.

(10)—Window and door frames can be set in the forms and the concrete cast around them. Wooden frames should be well primed as a protection from moisture in the concrete. Frames should be anchored to the concrete by means of long spikes or bolts. They should be braced against distortion from the pressure of the wet concrete.

(11)—Forms should be light enough or in sufficiently small sections to allow handling by the form setters without producing undue fatigue. They should be capable of positive alignment both vertically and horizontally.

(12)—The monolithic house offers an unlimited field for development. Encouragement should be given to the development of all systems of forms for the construction of monolithic houses.

(13)—The monolithic house offers advantages in speed of construction that makes it especially suitable for large housing developments.

Big Distribution of Safety Literature

The Ontario Safety League continues to place a large amount of literature in the hands of motorists, school children, industrial workers, and others throughout the province. In the first three months of 1920, the League has distributed an enormous amount of safety material, including 35,000 industrial safety bulletins, 32,400 school safety bulletins, 8,500 special bulletins, 8,500 traffic bulletins, 2,700 electric railway bulletins, 150,000 motorists' safety book-marks, 10,200 health bulletins, 6,500 news letters, 9,000 safety calendars, 12,000 leaflets to the "new man," 125,000 gummed seals and 3,000 safety cards and posters.

The city of Quebec has been notified that the Provincial Department of Municipal Affairs has placed a sum of one million dollars, of the Federal housing loan, at the disposal of the city. The city of Quebec asked for three millions.

Western Problems to Come Before Good Roads Convention at Winnipeg

First Meeting of Canadian Good Roads Association West of Ontario to Consider Conditions in That Part of Dominion

THE announcement that the Seventh Annual Canadian Good Roads Convention is to take place at the Royal Alexandra Hotel, Winnipeg, on June 1, 2, and 3 marks the first occasion on which this organization has gone west of Ontario in order to foster the campaign for improved highways, so that special efforts are being made by the executive of the Canadian Good Roads Association to ensure its success. The programme, which is now in course of preparation, is one that will specially appeal to the western municipalities, as apart from the general papers on different methods of paving, there will be given addresses dealing particularly with the road conditions and problems which exist in that portion of the Dominion.

The convention meetings will be held in the banquet hall and there will be an exhibition of road materials in the old ball room, while in the spacious ground in the rear of the hotel will be shown road and other machinery in operation. It is also proposed to construct a section of highway in the district under the supervision of the best experts on the continent who will thus be able to demonstrate the proper method of grading, ditching, draining, foundation laying and building up of a modern highway.

The Lieutenant Governor of Manitoba, Sir James A. M. Aikins, K.B., has been invited to formally open the convention, and invitations are being extended to the Premiers of every province in the Dominion, as well as the Ministers of Highways and other ministers to be present.

The Deputy Ministers of Highways from all the provinces are being specially invited as it is intended to hold special meetings for them for the purpose of discussing road laws, traffic regulation, automobile taxation, systems of construction and maintenance of highways and similar questions with a view to arriving as far as possible at a uniform system of regulations for the whole Dominion. Representatives of the Federal government will also be present at this conference, which will commence on the second day of the convention and proceed concurrently with it.

Information has already been received by the secretary, George A. McNamee, that large delegations will be sent from the Ontario Good Roads Association, the Eastern Ontario Good Roads Association, the Good Roads League of British Columbia, the New Brunswick Automobile Association, the Halifax Good Roads Association, the Quebec Automobile Club, the Automobile Club of Canada, the Central Canada Colonization and Highways Association of Fort William, the Pacific Highway Association of Maryhill, Washington, and other organizations, and special pullman cars are being arranged at all the big centres for the conveyance of delegates to the convention. Ladies are being invited to join the party, and the railway companies are arranging several trips from Winnipeg to allow delegates and their wives to visit points of interest in the west.

The annual meeting of the Canadian Automobile Association will be held at Winnipeg during the convention, with representatives from all the recognized automobile organizations in the Dominion attending.

Hints for the Contractor

That May Save Him Time and Money—We Will Pay for All Accepted Items—Send One In

Dangers of Salamanders in Heating Winter Concrete

WHENEVER reinforced concrete building work is done in the winter seasons, some artificial means of heating the structure must generally be installed. Salamanders are usually used for this purpose. In a weekly news letter of the National Safety Council, Mr. E. W. Bush points out that it is desirable that the salamanders be connected by piping to the outer air, or a chimney, as the burning fuel is a great consumer of oxygen, and workmen who perhaps are tending these fires during the night-time are quite apt to lie down to sleep beside the salamanders, and all the elements are present for a fatality. Reports were recently received of five or six men being knocked out on one job during the first night or two that the salamanders were in use. In another instance, a plasterer who was working on a scaffold near a salamander was overcome by the foul air, pitched forward, and sustained a very serious head injury as the result of his fall.

Blasting Concrete in Congested Districts

DESPITE the nearness of shopgirls, and the necessity for guarding against destruction of plate-glass and other frail property, dynamite was recently used in New York City in the demolition of a brick and concrete vault formerly occupied by a bank, according to Engineering News Record. The walls were 20 in. thick, and the vault 14 ft. long, 12 ft. wide and 7½ ft. high. The roof, supported by six 12-in. I-beams, was 2½ ft. thick. The whole constituted a ton of steel and 49 tons of brick and concrete. The first hole was drilled 13 in. into the wall near the door and loaded with one-third of a cartridge of 40-per cent. dynamite. This gave an idea of the size of succeeding charges that could be loaded. Three other holes were then drilled 18 in. apart about 18 in. from the end of the wall and fired with a blasting machine. The job was completed in 14 days at a net profit of $150.

Five plate glass windows 40 ft. from the scene of the blasting were protected by a canvas screen hung from the ceiling, and windows in the vicinity were boarded over. Five feet from the wall on one side with but a thin brick wall intervening were girls selling drygoods.

To Harden Concrete Rapidly

F. A. McLean*

IT is sometimes desirable to harden concrete quickly as in grouting or setting up pieces of heavy machinery which must be placed in operation as soon as possible. A simple method of accomplishing this which also has the advantage of accelerating the rate at which the strength of the concrete increases with age is to add small quantities of calcium chloride to the water which is used for mixing purposes. The best results are obtained when from 4 to 6 per cent. of the chloride by weight is added. While this process has no injurious effects when used to treat solid masses of ordinary concrete, care should be exercised when mixing this chemical with reinforced concrete that is exposed to the weather in which case it is likely to corrode the reinforcing bars.

Protection of Wooden Bridges from Fire

NINETY per cent. of the fires in wooden bridges and trestles of railways are caused by locomotive sparks, either from the smokestacks or the ash pan, according to a committee report submitted to the Railway Fire Protective Association.

Measures for preventing these fires were recommended as follows by the committee:

That effective spark screens be provided in the front end of all locomotives and carefully maintained.

That ash pans and grates be made tight and kept in good working order, as the dropping of hot coals or ashes is a source of a large amount of our trouble.

That special places be provided for the dumping of cinders and ashes, and grates are not to be shaken down except at safe points.

That all combustible refuse, such as dry leaves, dead grass, weeds, brush and rubbish, be cleared away from under and around all wooden bridges.

That the decks of all wooden bridges, between the rails, be covered with No. 22 galvanized iron, this to prevent sparks from setting fire to the structure should they be dropped from the locomotive.

As a further preventive measure, it is recommended that all wooden bridges be coated with a fireproof or fire-retardent paint, demonstration having proven some of them to be of excellent protection, and that they can be applied at a cost no greater than that of ordinary paint.

The committee also recommended that one water barrel and one pail be provided for all wooden bridges of a length of 50 ft. or less, and two water barrels and two pails, one to each barrel, be provided for all bridges whose length is more than 50 ft. up to a length of 150 ft., and that one water barrel and one pail be provided for each additional 150 ft.

That where a bridge requires one or two barrels and pails the same are to be placed at the ends of the bridge, located at proper clearance from the track and buried in the ground to within 6 in. of the top, and where barrels and pails are located in the middle of the bridge they are to be located at proper clearance from the rails and the top of the barrel is to be provided with a wooden or galvanized iron cover.

In the past great difficulty has been experienced in keeping the pails intact with the water barrels, especially where galvanized iron pails or fire buckets have been used, and they are invariably missing when wanted, and it is therefore recommended that a square wooden bucket of unfinished lumber be provided and that the same be suspended in the water inside of the barrel.

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*Of Canadian Ingersoll-Rand Company, Sherbrooke, P.Q.

As a further means of extinguishing the blaze, it is recommended that all locomotives be equipped with fire-fighting apparatus, so that they may cope with the situation should occasion arise.

Electric Power Inspector Honored

On Wednesday evening, March 24th, the staff of the Inspection Department, Toronto Hydro-electric System, gathered at their Club House, 30 Murray St., when Mr. G. W. Leach was the recipient of a handsome gold watch as a token of appreciation of his nine years' service as electric power inspector. Mr. Leach resigned March 1st, and has since joined the staff of Mr. J. Everard Myers, electrical engineer and contractor, as construction manager.

Mainly Constructional

East and West—From Coast to Coast

Ceramics Industrial, Ltd., will erect a brick plant at Vancouver. This will be the first plant of its kind in Vancouver.

The Canadian Northern Railway's program of construction in Saskatchewan will include 58 miles of grading and 184 miles of new track during the present season.

At a recent meeting of the Brotherhood of Carpenters, Toronto, it was decided, by a vote of 218 to 70, to accept the wage schedule of 85c per hour until June 1, and after that 90c.

The total value of building permits issued at Montreal for the first quarter of the present year amounts to $1,461,237. The figure for the corresponding period of 1919 was $440,102.

Announcement is made by Hon. J. H. King, Minister of Public Works, British Columbia, that approximately $8,000,000 will be expended on highways in the province during the next three to five years.

It is announced that Mr. J. H. Donlin, president of the Building Trades Department of the American Federation of Labor, together with presidents of all international building trades unions, will shortly visit Montreal to investigate conditions in the buildings trades there.

It is reported that the Canada Cement Company's plant at Hull, Quebec., will engage about 200 new hands in the near future. The plant has been practically idle all winter, owing to scarcity of coal, and kindred reasons.

An invitation has been forwarded by the Canadian Good Roads Association to the Lieutenant Governor of Manitoba, Sir James A. M. Aikins, K.B., to formally open the Seventh Annual Canadian Good Roads Convention which will take place on June 1, 2, and 3 at the Royal Alexandra Hotel, Winnipeg.

A banquet was held recently by the Toronto Master Painters' and Decorators' Association, at Toronto, in honor of the association's president, Mr .Stewart N. Hughes, who has just returned from a vacation in California. A resolution expressing pleasure at the return of Mr. Hughes, was moved by Mr. Wm. Paris and seconded by Ald. Phinnemore, to which Mr. Hughes replied, expressing his appreciation of the warm welcome given him.

Personal

Mr. W. W. Marshall, Hydro superintendent at Orangeville, Ont., has been appointed town engineer there, succeeding Mr. Charles King who resigned recently. Mr. Marshall will fill the two positions, with offices in the Waterworks Building.

Mr. J. Thompson, who has been chief draughtsman for Mr. Wm. R. Hood, architect, of Port Arthur, Ont., for the past four years, has left to take over the management of one of the departments of a large contracting firm at Brantford, Ont.

Mr. F. H. Smail, B.Sc., A.M.E.I.C., for eight years in the employ of the Saskatchewan Highway Department, Regina, has accepted an appointment in the city engineer's office, Moose Jaw, Sask. Mr. Smail is a graduate of Queen's University, Toronto, and saw four years' overseas service.

Mayor Westoby has resigned as secretary of the Housing Commission, Guelph, Ont., not having sufficient time to look after this work. Mr. G. M. Yates has been appointed to this position and has already entered upon his duties. An extensive program of house building is planned by the commission for the present year.

Mr. James Penner, of Derby, Ont., will succeed Mr. John Campbell as foreman of construction on the Owen Sound and Meaford provincial county highway. Mr. Campbell resigned this position to devote his time to his farm. Construction of this road was commenced last year under Mr. Campbell's supervision and three miles of roadway has been completed.

Mr. Adelhelm, instructor in structural design of a class made up from the draughtsmen of the Hamilton Bridge Company and Steel Company of Canada, Hamilton, was made the recipient of a wrist watch, by his pupils, on the occasion of his departure for Philadelphia, where he has accepted a position with one of the largest engineering concerns of that city. Mr Adelhelm, while in Hamilton, was in the employ of the Steel Company, as test engineer of the coke ovens. The course referred to above will be continued next October under the supervision of Mr. Ross, engineer with the Frid Construction Company, Hamilton.

Obituary

Mr. Alexander Davidson, senior member of the firm of Davidson Bros., contractors, of Winnipeg, died recently in his 68th year. Mr. Davidson was born in Leeds county, Ontario, and went to Winnipeg in 1882.

Trade Incorporation

McKay Building & Engineering Company, Limited, with head office at Regina, Sask., capital $20,000.

Niagara Falls Homes, Ltd., with head office at Niagara Falls, Ont., capital $250,000, to build houses.

Ontario Cement Co. Ltd., with head office at Brantford, Ont., capital $1,000,000, to manufacture cement.

Standard Sand, Limited, with head office at Montreal, capital $150,000, to deal in sand, lime, stone, etc.

Angstrom & Verochio, Limited, with head office at Toronto, capital $100,000, to carry on the business of general contractors.

Joncas, Malouin & Rousseau, Limited, with head office at Quebec, P. Q., capital $20,000, to carry on the business of general contractors.

Sarnia Chamber of Commerce Building Co., Ltd., with head office at Sarnia, Ont., capital $50,000, to carry on the business of builders and real estate dealers.

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks, Sewerage and Roadways

Amherst, N. S.
Tenders will be called shortly for grading and paving in connection with contemplated drill hall costing $25,000 for Dominion Dept. Public Works.

Brandon, Man.
D. W. Shaw, secy.-treas. for Municipality of Cornwallis, Room 35, Smith Block, Brandon, Man., will receive tenders until noon April 16th for draining and grading about 62½ miles of road; cost, $200,000. Specifications with secy.-treas. and Good Roads Commissioner, Winnipeg.

Drumbo, Ont.
Hugh Allan, clerk, Drumbo, will receive tenders until April 9th for supplying tile and construction of drain for Blenheim Township.

East Angus, Que.
Municipality contemplates gravelling of road. Secy.-treas., J. A. Girard.

Harding, Man.
W. V. Stevenson, secy.-treas., Harding, Man., will receive tenders until April 10th for construction of concrete culverts for Municipality of Woodworth. Plans with Mr. Stevenson and with Highway Commissioner, Winnipeg.

Joliette, Que.
Municipalities of Joliette and L'Assomption contemplate construction of road. Secy.-treas. for Joliette, J. E. Chaput.

Jonquieres, Que.
Municipality contemplates construction of macadam road costing $12,000. Clerk, M. Lacroix.

Middlechurch, Man.
H. I. Thomson, secy.-treas. for Rural Municipality of West St. Paul, Middlechurch, Man., will receive tenders until noon April 17th for grading Rosser Road. Specifications with A. McGillivray, Highway Commissioner, Winnipeg.

Montreal, Que.
City has voted $2,409,637 for completion of aqueduct and construction of new low level pumping station. Engineer, A. E. Doucet. R. S. & W. S. Lea, 10 Cathcart St., are consulting engineers. Tenders will be called shortly.

Murray Bay, Que.
J. McNicoll, secy.-treas., will call tenders soon for gravelling road for Municipality.

Ottawa, Ont.
Dominion Dept. Public Works contemplates expenditure of $75,000 on dredging work in provinces of Manitoba, Saskatchewan and Alberta.

Peterboro, Ont.
City will construct extension to water mains by day labor costing $12,462. Chairman Utilities Commission, W. H. Moore.

Powasson, Ont.
Town will call tenders about June 1st for cement walks to cost $8,000. Clerk, L. G. Phillips.

Raymond, Alta.
Town has under consideration paving work to cost $14,000. Address mayor.

Sherbrooke, Que.
By-law passed authorizing expenditure of $300,000 on waterworks for city. Mayor, C. D. White.

E. C. Gatien, city clerk, will receive tenders until April 15th for 500 tons of inorganic dust filler, 450 tons of asphalt cement, 16 tons asphalt filler on metal drum, granite blocks.

Simcoe, Ont.
Tenders will be called shortly for macadamized roads, curbs, etc., for Town. Clerk, W. C. McCall.

St. Clair Beach, Ont.
J. H. Coburn, clerk, Walkerville, will receive tenders until April 10th for construction of 5 miles of pavement for Municipality.

St. Francois De Salles, Que.
N. T. Boudreault, secy., will call tenders soon for gravelling road from St. Francois de Salles to Chambord for Municipality.

St. Fulgence, Que.
J. E. St. Georges, secy.-treas., will call tenders soon for gravelling of road for Municipality.

Toronto, Ont.
T. L. Church, Chairman Bd. of Control, will receive tenders until April 13th for construction of sewers. Specifications at Works Dept., Room 6, City Hall.

Westbury, Que.
Municipality contemplates gravelling of road 4½ miles long. Secy.-treas., J. A. Girard, East Angus.

Windsor, Ont.
City contemplates construction of concrete sidewalks costing $70,000. Engineer, M. E. Brian, City Hall.

CONTRACTS AWARDED

Cornwall, Ont.
MacLean & Stidwell, Cornwall, have contract for crushed stone for Provincial Dept. Public Highways, Toronto.

Matane, Que.
Terreau & Racine, St. Paul St., Quebec, have contract for material in connection with construction of sewer and waterworks system costing $80,000 for Municipality.

St. Prime, Que.
Emile Giroux has general contract for gravel road costing $15,000 for Municipality.

Toronto, Ont.
Provincial Dept. Public Works placed contract for Portland cement with Canada Cement Co., Bank of Hamilton Bldg., Toronto; Alfred Rogers Ltd., 28 King W., Toronto.

Castellani Construction Co., Excelsior Life Bldg., Toronto, have contract for earth work on highway in Townships of East and West Whitby for Provincial Dept. Public Highways.

Provincial Dept. Public Highways placed general contract for filling in swamp on Provincial Highway in Pittsburg Township, with Dufferin Construction Co., Lumsden Bldg., Toronto.

Ed. Brule, Box 107, Billings Bridge, Ont., has contract for crushed stone required on highway in Nepean Township for Provincial Dept. Public Highways.

Provincial Dept. Public Highways placed general contracts for concrete structures, rock work, etc., at Shannonville, and road work, etc., in Township of Richmond, with Chisholm Wellage Co., South Lancaster.

Windsor, Ont.
Essex Border Utilities Commission placed general contract for completion of south sewage interceptor with Border City Construction Co., Gas Bldg., Windsor.

Woodstock, Ont.
Sewer and activated sludge costing $110,000 for City: Construction work, $42,836.80, W. H. Brennan Contracting Co., Hamilton; sewage disposal works, piping and installation of machine, $37,309, Flanagan & Anderson, Fort William; filtro plate, $4,551.84, General Filtration Co., Rochester, N. Y.; two 30 h.p. motors, $2,394, Canadian General Electric Co., 212 King W., Toronto; two No. 4 Nash Hytor compressors with separators, $3,255, Canadian Fairbanks Morse Co., 26 Front St. W., Toronto.

Railroads, Bridges and Wharves

Bognor, Ont.
Sydenham Township contemplates construction of steel bridge. Clerk, J. M. Thomson, Bognor.

Elmvale, Ont.
Plans are in progress for bridge costing $5,000 for Simcoe County Council. Clerk, R. J. Fletcher, Barrie, Ont.

Esquimalt, B. C.
Tenders will be called shortly for graving dock costing about $1,500,000 for Dominion Dept. Public Works.

Fort Garry, Man.
H. D. DeMoissac, secy.-treas., will receive tenders until April 13th for con-

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Remodelling of Old Houses into Modern Apartments Proves Profitable

Of late the housing scarcity has developed a new line of building operations that has proved very successful and profitable—the remodelling of well constructed buildings of old types and their transformation into up-to-date apartments. Tenants today are demanding modern houses. They do not wish to be forced to live in antiquated houses with out-of-date facilities, nor, if possible, do they care to pay the high rentals demanded for apartments constructed in the last few years of high costs. The remodelling of the old residences has not only helped to solve this problem but has also been a source of profit to the owners of buildings of this type, who have viewed with apprehension their steadily decreasing revenue and increasing depreciation.

The erection of a modern apartment house requires a considerable investment and is an impossibility to the man with a capital of only a few thousand dollars. A very satisfactory return on small outlays can be readily obtained from buildings, otherwise non-producing, by converting them into suites of two or three room apartments with modern facilities. For this particular type of residence, there seems to be an ever-growing call, incident upon the steady increase in the business and population of our cities.

One instance of the success with which an improvement of this character met was recently drawn to our attention. There was, originally, a house of an obsolete type renting for $35 a month. Although its condition was such as to make it legitimate prey for the house wrecker, it was remodelled at a cost of $6,500, resulting in a modern apartment building of six suites, each comprising two or three rooms, all exceptionally well lighted and ventilated. The owner now receives a rental of $200 per month, or $2400 per annum. The gross return on the investment is thus 36%. This case illustrates what the owners of old buildings can reasonably expect from an expenditure of a comparatively small amount in remodelling. From the point of view of the contractor, however, a new field has opened up which can prove profitable to him from a monetary standpoint and result in a growing business through the appeal which the scheme makes to owners who have but a small amount of money to invest in building.

Both Lump-Sum and Cost-Plus Contracts Endorsed by Contractors

"Two sides to every question," is a truism that applies to the selection of a building contract as much as to other matters. Perhaps it would be better to say that to this question there are many sides, as the types of contracts are by no means limited to two. However, between the lump-sum or fixed cost contract and the cost-plus type there has always been a sharp line with each strongly advocated by its own sponsors. Articles in the Contract Record from time to time have pointed out the arguments that appeal to their respective advocates and as recently as our last issue we published the views of a contractor who favors the fixed cost basis of construction. The contractor in question, Mr. James O. Heyworth, in defending the lump sum contract, believes that it is a form of contract that fully protects the owner, provided there is that mutual confidence on which any type of contract should be based. The cost is stated to be the standard by which the ability of the contractors is measured and the success of the work determined. If the work has cost more than the contractors get for it, they have been a failure; if it has cost less than they get for it, they have been a success. It is Mr. Heyworth's claim that between the fixed cost contractor and his organization there grows up a reliance of one upon the other and a loyalty to each other, developed during years of work on the solution of problems to ensure success, as measured by their ability to perform the work within a contract price. Necessity is the compelling force, claims Mr. Heyworth, that makes the contractor select and watch more carefully all the men in the organization. "Where cost is success or failure, the men themselves soon weed out the slackers and poor workmen." This contractor believes that the fixed cost basis of construction is an incentive to urge the men to do their best work and believes that they take a pride in winning out.

The advocates of the cost-plus-fee plan have strictly divergent views. These are typically expressed in our March 3 issue, by Mr. F. A. Wells. It is Mr. Wells' contention that a lump sum system gives opportunity for arbitrary and unfair rulings against a contractor in favor of the owner, and that it kills the co-operation that should exist between the various interests concerned. The cost-plus-fee is urged as a means of securing this co-operation. Mr. Wells places the interests of the owner first and claims that in every department the fixed fee contract caters to those interests. Added speed in construction and the elimination of the dishonest builder are two points that are claimed to be worth while advantages of this type of contract.

Our own viewpoint is that while the advocates of the lump-sum contract make some good points in its favor, present conditions demand the use of some good form of cost-plus contract. The unsettled conditions in the building business and the uncertainty of prices are important factors in its favor. Under these conditions the interests of both the contractor and the owner are more safely protected. No owner wants the cheapest building that can be erected on the basis of a given plan and specification, but this is exactly what he gets under the lump sum contract. He should expect to pay for services obtained and there is no fairer way of ensuring this than by the method that exactly determines the cost and allows a fair profit.

Advisory Conference Committee on Engineering Legislation

In common with their fellows of other provinces, the engineers of Ontario are keenly interested in obtaining suitable legislation to establish their status and to regulate their practice. To accomplish any real results, it was realized that all branches of engineering should be consulted, and that all kinds of divergent opinions must be brought together on common ground.

The Advisory Conference Committee has been formed with this end in view. The Committee consists of two representatives of each of the following organizations: Canadian Mining Institute; Engineering Institute of Canada (Ontario Division); American Society of Mechanical Engineers—(Ontario Section); American Institute of Electrical Engineers (Toronto Section); Canadian Institute of Chemistry; Association of Ontario Land Surveyors and Ontario Association of Architects.

The above organizations have been chosen as most representative of their respective branches of engineering in Ontario.

Two lengthy sessions have already been held, and much progress has been made towards the establishment of broad general principles, upon which legislation should be based. Now that the work is well organized, it is the intention of the committee to pursue the matter vigorously until a conclusion has been reached. The task is not an easy one, and if some considerable span of time should be found necessary to its fulfillment, it will be because the committee wish to be thorough, and to bring in a report which can be freely endorsed by both parties. The matter is being considered by the committee with a view to meeting the requirements of the different branches of the profession as well as eliminating grounds for objection on the part of any branch, while retaining one general organization of the whole profession. It is perhaps not going too far to say that the results of the conferences already give reason to expect a satisfactory conclusion.

The views of all engineers of Ontario are sought, and any of them may feel free to communicate with the committee to this end. Mr. Clifford E. Smith is chairman; Mr. Willis Chipman, vice-chairman, and Mr. F. R. Ewart, secretary. Communications may be addressed to the latter at 207 Excelsior Life Building, Toronto.

A Code of Practice to Govern Tendering Operations

A CODE of practice to govern the taking of bids and letting of contracts has been prepared by a joint committee representing the Master Builders' Association of St. Louis and the St. Louis chapter of the American Institute of Architects. While conforming in the main to provisions of similar codes adopted in other cities it differs in some respects, and is remarkable for its brevity and succinctness. Following is the code:

1. Whenever possible, bids should be opened at a fixed hour and specified place, and should be made known to all bidders as promptly as possible.

2. Invitations to submit proposals should be confined to contractors with whom the owner or architect will enter into contract for the performance of the proposed work. The lowest bidder invited is entitled and should be awarded the contract for the work bid on.

3. Bids should be submitted on plans and specifications, and addendas, provided by the architect. Addendas should be given all bidders in ample time to permit them to make necessary revisions in their estimates.

4. When sub-bids are to be taken by the architects or owners, all bidders should be advised thereof at the time they are invited to submit estimates.

5. When a contractor is invited to submit an estimate, and he is unable or unwilling to compete for the proposed work, he should immediately notify the architect to that effect, and should not submit a borrowed or accommodation bid. Such methods are considered unfair to the architect and are condemned as bad practice.

6. When the lowest bid is rejected, it should be considered unfair to offer the contract to a higher bidder, or any other contractor, at the rejected bidder's price.

7. All bidders are entitled to and should receive a list of such contractors as are invited to submit estimates.

The Master Builders' Committee further suggests that some plan should be devised whereby the contractors invited to bid shall be reimbursed for the cost of their services.

In British Columbia records show that by the aid of the federal housing grant 50 houses have been built and occupied, 90 under construction and 249 expected to be built this year. On the allotment of $1,107,150, there has been advanced to date the sum of $388,300 in British Columbia.

No. 19

Canada's Engineers—Chas. P. Disney

The subject of the sketch in our "Canada's Engineers" section this week is Captain Chas. P. Disney, whose recent appointment as engineer of bridges, eastern lines, Canadian National Railways, Toronto, was announced in the Contract Record of March 3. Capt. Disney is one of the many Canadian engineers who saw prolonged service overseas and who followed upon the heels of the Germans in their great retreat before the armistice. He was born at Montreal in 1877 and since 1902 has been continuously connected with bridge engineering. He began as bridge draughtsman with the Dominion Bridge Company, Montreal, by whom he was employed from 1902 to 1905. From 1905 to 1906 he was steel checker with the Locomotive and Machine Company of Montreal, afterwards, the Montreal Locomotive Works, and for the next two years he went to the Massachusetts Institute of Technology at Boston, for technical training in engineering. Mr. Disney then went to the bridge engineer's office of the National Transcontinental Railway, at Ottawa, and was engaged on designing and estimating till October, 1914, when he joined the bridge department of the Intercolonial Railway at Moncton, N. B., remaining there till September, 1915. He then joined the Canadian Engineers and saw active service in France continuously for four years, the first eighteen months as a sapper, then as a lieutenant and captain in the Royal Engineers. On his return, he joined the engineering staff of the Canadian National Railways, being appointed, as indicated previously, engineer of bridges, eastern lines.

Capt. Chas. P. Disney

Bid Bonds Guarantee Safety

Editor, Contract Record:

Your article which appeared in the "Contract Record" of April 7th, revealed a rather startling form of manipulation of contractors' moneys by an ingenious rogue, and well might this incident open the eyes of contractors and result in their taking immediate steps to secure safer conditions under which tenders might be made.

As a guarantee underwriter, I was highly amused at the comical awkward situation in which these business men found themselves when they assembled at the same hotel in Montreal, each of them imbued with the self-satisfied feeling that he was the lucky man, unconscious at the time that the schemer with whom he had deposited a marked cheque in support of a tender on a mythical pulp mill, had decamped with the money after being clever enough to allay suspicion by arranging appointments with each and all of them. This naturally leaves the contractors in a hopelessly ridiculous plight from a business point of view.

It is very true that a man learns from experience, but often such experience comes to him too late and results in his cursing fate for not adopting more progressive methods. It might be of interest to the many contractors who subscribe to this useful journal to know that the above unfortunate episode could have been averted had the contractors concerned been farsighted enough to obtain a bid bond at a nominal premium of five dollars ($5.00) from one of the many guarantee companies writing bid, guarantee and maintenance bonds.

A bid bond, in this particular instance, would have served the twofold purpose of:

1. Eliminating the necessity of the contractor's reducing his current bank account.
2. Rendering it impossible for a dishonest and unprincipled person to take advantage of the contractor.

The bid or proposal bond is accepted in lieu of an accepted cheque, and guarantee companies write such a covering at a minimum rate of five dollars ($5.00) with the understanding that if the successful bidder secures his contract bond from the same surety, the premium paid on the bid bond for that contract shall apply as part payment of the premium on the contract bond.

It will be seen from the foregoing that the contractor has everything to gain by falling in line with an up-to-date method of filing his tenders, and it is to be hoped that all contractors' associations throughout Canada will take a firm stand in refusing to tender on contract where the surety bond of an authorized guarantee company will not be accepted.

Yours truly,

Stephen P. Armstrong,
Manager Guarantee Dept.,
General Accident Assurance Co. of Canada.

Messrs. Phinn Bros. of London, Ont., have purchased the business of the Grimsby Brick and Tile Co., Grimsby, Ont., and will carry on business at Grimsby under the same name.

The Department of the Interior of Canada, through the Reclamation Service, has issued a report on Irrigation Surveys and Inspection for 1918-19.

A general view of the International Paper Company's plant

Large Pulp and Paper Mill Development by International Paper Co. at Three Rivers

100 Ton per Day Sulphite Mill is Nearly Completed—Newsprint Mill with Capacity of 200 Tons per Day to be Started Shortly—Workmen's Dwellings in Connection with Plant

By Romeo Morrissette, C.E., A.M.E.I.C.

WHEN on August 27, 1919, His Excellency The Governor-General turned the first sod of earth on the site of the St. Maurice Lumber Co's. new mill, a subsidiary of the International Paper Co., of New York, a new era in the industrial life of Three Rivers was inaugurated. The decision to carry out this large scheme on which engineers had been engaged for many years previously was partly due to the laws of Quebec, by which the Provincial government is prohibiting pulp wood exportation from public lands, thus conserving their forest resources as a real national asset.

As shown on the general plan, the new mills are located on the "American Point," on the north-eastern side of Three Rivers, the property being situated at the apex of the angle made by the St. Lawrence and St. Maurice Rivers. This site is advantageous by its rail and boat facilities and was named the "American Point" on account of the first sawmill being built there in 1848, by two Americans, Messrs. Norcross and Philipps. At that time, the total quantity of logs driven along the St. Maurice River was 200,000 pieces per year. Today, over 15,000,000 logs are driven in a season down the St. Maurice River. The St. Maurice Lumber Co. is now completing a sulphite mill of a capacity of 100 tons per day. When this is finished, operations will be started immediately on a newsprint paper mill with a capacity of 200 tons per day. The paper mill will be completed in the fall of 1921. In the meantime, the company will ship the sulphite pulp manufactured at Three Rivers to the newsprint paper mills of the company in the United States.

The scheme involves an oil storage tank divided into four rooms with a capacity of 150,000 barrels. The tank will be of reinforced concrete, measuring 72 ft. x 146 ft. x 20 ft. The oil will be discharged directly from tank cars or tank sea freighters into the reservoirs from which it will be pumped to the oil burners in the boiler room The excavation for the tank is carried on by the general contractor, G. L. Campbell, Montreal and the work is progressing well. Dynamite is used to break the frozen soil, which is loaded by steam shovels into small dump cars operated on railway tracks with small steam locomotives. The excavated material is taken half a mile away from the reservoir site and a train is loaded every ten minutes.

On the left is shown the main building with the steel frame in course of erection. The boiler house is illustrated on the right.

No contract will be awarded for the erection of the concrete structure as it will be done by day labor under the supervision of the company's engineers.

The Buildings

The first building on which work was started was the boiler house, 92 ft. x 60 ft. The foundations are of 1:3:5 concrete, finished with one coating of Monitor 1:2 concrete plaster. The walls are of brick, 16 inches thick. The structure is steel with columns encased in fireproof bricks and the beams in concrete. The roofing is made of concrete slabs. Four B. & W. boilers, of 500 h.p. capacity each, are to be installed. They will be heated by oil but provision is made to burn coal in case of emergency.

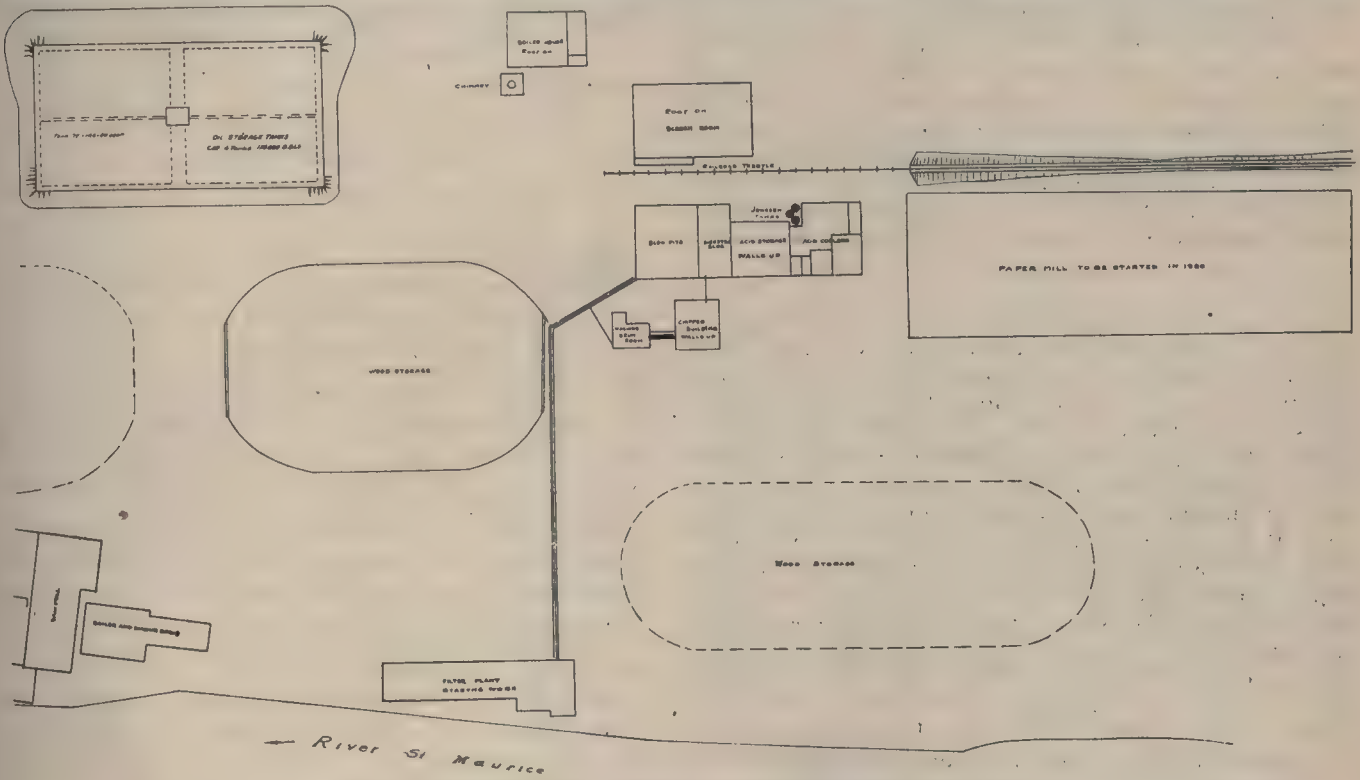
The next building constructed was the screen room, 132 ft. x 82 ft. The materials used were the same as in the boiler room, with the exception that the beams and columns are encased in 1:2:4 concrete It is in the screen room that the wet pulp received from the washing room is pressed in sheets and cut to dimensions. This building is nearly completed.

The main building is nearly framed up. It contains the blow pit, digester room, acids storage tanks and coolers. The dimensions are 560 ft. long x 85 ft. wide. The first section is the blow pit which is 85 ft. x 39 ft. 6 in. in plan, varying from 18 ft. 9 in. to 16 ft. 9 in. in height. It is a kind of reinforced concrete box into which the hot pulp mixed with chemical products runs from the digesters. The pulp is first freed from the principal chemical ingredients with which it has been cooked, before it has reached the washing room, where the pulp will be completely cleaned of any foreign ingredients. On account of the high pressure exerted on the sides of this tank, the 1:3:5 concrete walls, 2 ft. 3 in. wide, have been reinforced with 18-inch steel I-beams spaced 3 feet centre to centre. Inside, the concrete is wainscotted with 8 in. x 8 in. B. C. fir sheathed with a 3-inch B. C. fir planking.

The next section contains the digesters. This room is 85 ft. x 38 ft. in plan and 62 ft. high. This building will contain two digesters, 15 ft. in diameter by 47 ft. high and 10 inches thick with vitrified brick inside, resting on 9 steel lacing bars 2 in. x 5/16 x ½ in. at 5/32 centres. These lacing bars are to rest on a concrete foundation. These digesters are upright cylinders of mild steel plates, one half inch thick with butt-joints, the inside rivet-heads being countersunk. The tanks have egg-shaped tops and bottoms. They are equipped with blow-off valves at the top, and run-off valves at the bottom, steam wheels and check valves. The shells of these digesters are ordinarily submitted to a pressure attaining sometimes to 140 pounds per square inch above atmosphere. In the case under consideration, it is assumed that the average pressure will be 90 pounds per square inch when the liquor runs from the digester to the blow-pit. The capacity of one of these digesters per charge expressed in tons of air-dry pulp will be approximately 10.33 tons of fibre per charge or 23.31 cords of wood per cook (one cook per eight hours). The third section is the acid storage room which contains three vertical steel circular tanks and one reclaiming tank. All are of the same diameter. There is room also for acid coolers, chemical laboratory, small office, toilets, showers, baths, sulphur burner room and a sulphur storage.

In front of the main building, will be situated three Jenssen circular tanks, two of these of reinforced concrete, and one of cut limestone. The purpose of these tanks is to obtain wood fibres which are used for the finest grades of paper. There the pulp is filtered, washed and chemically treated.

On the east side of the main buiding is the chipper room, 100 ft. by 56 ft. In this building are located the chip cutters or special machines which chop the wood logs in thin pieces. Then they are sent to a special drying room or chip bin located over the digesters. At each cooking, chips are first admitted alone from the



Plan of International Paper Company's development at Three Rivers, P.Q.

drying room to the digester. When this latter is filled in, acids are blown off gradually until the cooking heat is attained.

On the left of the chipper room, there is the washing drum room where the pulp wood is washed in horizontal rotary tanks. There the wood is freed from all dirtiness before reaching the chipping machine.

At the foot of the hill on the St. Maurice River is the filter plant consisting of a pumping house equipped with a filter. Its dimensions are 210 ft. x 42 ft.

The whole will be protected by a wall of steel sheet piling. The contract for the pile work has been awarded to the Raymond Concrete Pile Co., Ltd., Montreal. The foundation of the plant will be of concrete, reinforced with ½ inch square twisted rods spaced, lengthwise and cross-wise, 8 inches centre to centre. This plant will be equipped with 10 Cameron pumps, horizontal and vertical types, varying from 2½ inches to 20 inches in diameter.

The foundations of all the buildings consist of 1:3.5 concrete, finished with a Monitor plaster coating (1:2 concrete). The dimensions of foundations vary with each buiding. They are all designed to receive a 16 inch wall in rustic brick (4 rows). The columns and beams are encased in 1:2:4 concrete. The structure is of steel and the roof consists of concrete slabs (Siegwart System), lying on Pratt trusses. The loading panels are on a level with the trusses.

Contracts

The brick has been supplied by the National Brick Co., Ltd., Montreal; the cement by Arthur Nobert, Three Rivers; the crushed stone, by the Shawinigan Quarry Co., Ltd., Shawinigan Falls; the concrete slabs, by the Three Rivers Siegwart Beams Co., Ltd., Three Rivers; boilers, by Babcock & Wilcox, New York; machines, by Oliver Machinery Co, New York; 36 inch clay pipe for sewers and drains, by Standard Clay Products, St. Jean, Que.; iron pipes, by Canada Iron Corporation, Three Rivers; cementing of roofing, copper drains, etc, by C. E. Hamelin, Three Rivers; sash and doors, by J. H. Gignac, Ltd., Quebec; structural steel, by Dominion Bridge Co., Ltd., Montreal; hardware, by J. B. Loranger, Three Rivers and P. A. Gouin, Three Rivers; glass, by C. Labelle & Cie, Chimney Co., New York. The electrical equipment is being installed by the Canadian Comstock Co.

Housing Problem

The Company has just awarded a contract to Anselme Dube, general contractors, Three Rivers, for the construction of a series of laborers' dwellings. They will be terraces of houses each containing from 5 to 7 rooms. The foundations will be of concrete and there will be a brick frame, hot air heating, hardwood flooring, electric lighting, hollow concrete tiles for partition wall, asbestos shingles for roofing, etc. These houses will be located on St. Paul street, northward to the Ste Cecile church, on the property recently bought by the company. The location is two blocks from the mill site.

It is expected that the newsprint paper mill will be started during this summer. However, the writer cannot give any information about this, as plans are not completed yet. As it is noticeable from the photos, the work is progressing rapidly. It has been, since the beginning, under the management of Mr. T. R. Remsen, C.E., M.A.S.C.E., construction manager of the new mill at Three Rivers. Mr. Remsen is practically a Canadian, as he was, for a long while, engaged in engineering activities with one of our largest paper mills in Quebec, The Laurentide Co., Ltd., of Grand'-Mere.

A well known business man whose wide experience and great activities have largely contributed to bring to Three Rivers the establishment of these mills, is Mr. Robert F. Grant, managing director of the St. Maurice Lumber Co. for the last 25 years.

As soon as the actual mills are completed, they will be handed over by the International Paper Co., of New York, to the St. Maurice Lumber Co. which is incorporated under the Quebec laws with a special charter. The writer is indebted to Mr. Remsen and his assistant, Major Clemens King, for much information contained in this article.

New Type of Plow Cleans Snow from Streets at Low Cost

Eight Yard Trucks Filled in 1 to 1½ Minutes—Saving is $5.48 per 8 Cu. Yds. Over Hand Methods

A NEW device for cleaning snow from city streets, known as the Friedman Snow Tank, has been tried out in New York with splendid results. According to the information which is available, concerning the operations of the machine, its efficiency is quite remarkable and the cost of handling snow is very low. The unit, it is claimed, will load approximately 1300 trucks of eight cubic yards capacity per day, and at a recent demonstration for the New York City authorities, four 5-ton trucks were filled with ice in less than three minutes.

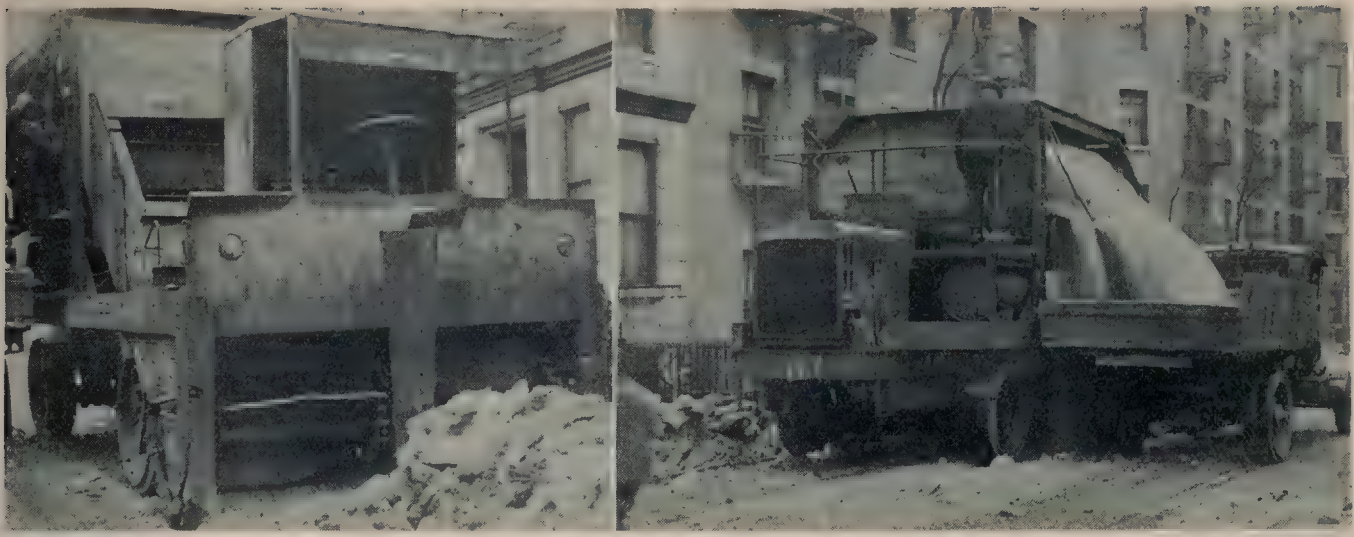
The unit seems to be comprised of a regular Christie four wheel drive truck with a special frame, the truck being operated in the usual manner. Over the rear wheels of the truck is mounted a 6-cylinder, 5½ in. bore, 6¾ in. stroke Sterling engine, which receives its cooling water from the radiator. Two operators are required, i.e., the driver of the truck and the mechanic who stands on the rear platform and operates the motor underneath, also the levers for the operation of the loading slides. The fuel tank is located on each side of the motor. The Sterling motor is started electrically from the rear platform.

The machine has the following dimensions: Length, 26 ft.; width, 9 ft. 6 in.; height, 12 ft. 6 in.; weight, 22 tons. It operates on four speeds ahead and one reverse with a speed of two to ten miles per hour; it travels to work at ten miles per hour.

The machine clears a path, by depositing the snow to one side, in a ridge, or in piles of ten cubic yards each. The speed of operation depends on the depth of snow, the following table giving the relation:

In a 6 inch fall the rate is 8 miles per hour.
In a 8 inch fall the rate is 7 miles per hour.
In a 12 inch fall the rate is 5 miles per houh.
In a 18 inch fall the rate is 3 miles per hour.
In a 24 inch fall the rate is 2 miles per hour.

It is possible to load a flat car or similarly shaped vehicle travelling parallel to the machine at the rate of fifty cubic yards of snow per minute, and at the rate of ten to twenty-five cubic yards per minute with frozen snow or ice. A truck with a capacity of eight cubic yards can be loaded in from one to one and a



The new type of snow removing machine will handle ice frozen to the streets as well as loose snow, loading it on trucks travelling alongside the plow

half minutes, depending on the condition of the snow or ice.

The process of handling the snow consists of two operations:

1. The conveyor, consisting of shovels attached to endless chains, cuts into the snow or ice as the machine moves along, and carries it up to a hopper, or movable platform.

2. When the transverse conveyor, or hopper (box-like receptacle) is filled, the door at the side is lowered and a lever thrown. This empties the snow into the truck. In clearing a path, the door is down, and the snow is discharged continuously.

To indicate the saving in the cost of handling snow as a result of using these machines, the following comparison is made:

Clearing Snow By Hand	
Loading	
8 men, 20 minutes, at 50c, minimum, per hour	$1.33
Auto truck at $4.00 per hour, waiting 20 minutes while being loaded	1.33
Cost of loading	2.66
Auto truck carting snow and returning, average min.	1.00
Cost of loading and carting	3.66
Cost to city, 8 cu. yds. at 54c per cubic yard	4.32
Plus expansion 25% (6 yds. on ground expand to 8 yds. in the truck)	1.08
Actual cost to city of loading and carting 8 cu. yds.	5.40
Piling, 8 cu. yds. at 9c. per cu. ft.	.72
Total actual cost to city of piling, loading and carting, 8 cu. yds.	6.12

Clearing Snow By Machine	
Loading	
3 men ($60 per 24 hrs.) filling truck in one min	$ .04
Gas and oil (5 gal. per hour)	.03
Wear and tear ($25 per 24 hrs.	.02
Overhead ($50 per 24 hrs.)	.04
Auto truck, waiting one minute while being loaded	07
Cost of loading	.20
Auto truck carting snow and returning, averages 15 minutes	1.00
Cost of loading and carting	1.20
Minus, compression 50% (16 yds., on ground, are compressed, by force of conveyors, to 8 cu. yds,)	60
Actual cost of loading and carting eight cu. yds.	.60
Piling, eight cu. yds.	,04
Total actual cost of piling, loading and carting 8 cu. yds.	64

The difference in cost per eight cubic yards is thus $6.12, less .64 or $5.48. Allowing two hours daily for rest, filling with gas, oiling, change of shifts, etc., there remain twenty-two working hours daily. The machine can fill approximately 1300, eight cubic yard trucks, daily. This means a saving of $7,000 daily with one machine.

The Friedman plow not only removes snow but handles ice frozen solid to the pavement. As evidence of this we quote from a letter to Dr. Samuel Friedman, the originator of the machine, from Percy Braman, deputy commissioner of public works, Milwaukee. Mr. Braman states: "The way it handled the four to six feet high by about eight feet wide pile of ice, frozen solid to the pavement, elevating it into a hopper and loading into auto trucks faster than they could take it away was a revelation to me. In my opinion you have solved the snow removal problem not only from city streets, but also from the main arterial highways throughout the country, which will make possible the successful operation of motor trucks, tractor and trailer trains during the winter months."

Canada Leads in Asbestos Production

The following figures indicate the production of asbestos crudes and fibres, in the various countries in which asbestos is mined:

		Tons	Value
Canada	1918	142,375	$9,019,899
Rhodesia	1918	8,574	761,683
Cape	1917	2,999	240,489
Transvaal	1918	3,193	172,173
United States	1917	1,683	506,056

1918 production of Cape (So. Africa) and United States not yet available. Canada has an enormous lead in this field, and will undoubtedly retain it for many years. Canadian production shows very slight increase over previous years in tonnage, but total value has advanced tremendously.

Bearing the title, "Is This Sound Reasoning?" a pamphlet just issued by Westinghouse, Church, Kerr & Co., engineers and constructors, of New York and Montreal, explains briefly the fairness of the cost-plus-a-fee method of doing work. This method has been exclusively employed by the W-C-K organization for the past twenty years.

Toronto Builders Hold Enthusiastic Meeting

Discuss Current Conditions in Construction Industry — Make Offer to Build Houses at Cost Plus Five Per Cent.

A GENERAL meeting of the Toronto Builders' Exchange was held on Wednesday evening, April 7, in the Board of Trade lunch room, Royal Bank Building, Toronto. The meeting, which was presided over by the president, Mr. C. B. Jackson, commenced with a dinner at 6:30 p.m. Following a toast to the King, Mr. Jackson delivered a brief, but very effective and comprehensive address, dealing with the present-day cost of building. He stated that building was being held up by the false impression of the public that the present advanced cost of building was but an abnormal condition which existed for the time being and which was liable to readjust itself to a pre-war basis at any time. This, however, seemed impossible, in view of the fact that labor cost and the cost of all other products had advanced too, and he could not see that anyone would benefit by a general decline. Wages would simply drop with the cost of living, as one practically determined the other. He looked for present conditions to be maintained for the next couple of years at least and urged the members to educate the public to the fact that there was nothing to be gained by delaying construction.

At the conclusion of Mr. Jackson's address, he called upon Ald. Phinnemore, who, on behalf of the members of the Exchange, presented Mr. A. D. Grant, last year's president, with a handsome black club bag, for his wife. Mr. Grant, on coming forward to accept the presentation, was greeted with "See Him Smiling." Ald. Phinnemore, in making the presentation, stated that it was in recognition of services rendered for which all the members were deeply appreciative. Mr. Grant, in a few words, expressed his own and his wife's thanks for the handsome gift.

A Manufacturer's Point of View

Mr. Armstrong, of the Port Hope Sanitary Mfg. Co., addressed the meeting as a representative of the manufacturers, and stated there should be the greatest fraternity of interests between the manufacturer and the contractor, and expressed the hope that at some future time the two bodies would combine in one organization for the good of trade. Continuing, he stated that more publicity should be given to the fact that the cost of materials for building purposes had advanced and the extent of the advance. Contractors would have no difficulty in showing that increased prices were legitimate. He urged the members of the building industry, when making arrangements with labor, to act wisely and endeavor, as far as possible, to avoid strikes and disturbances; not to give in to all kinds of ridiculous demands, but to meet the men and discuss the matter intelligently with them, aiming at the best possible solution of the problem to the interests of everybody concerned. Mr. Armstrong, in touching on the housing situation in Canada to-day, blamed some of the contractors for giving the people the impression that the high cost of building could not continue and advising them to defer operations. "Your propaganda should be," said Mr. Armstrong, "that building costs cannot possibly come down for the next few years at least. There is a shortage of houses in the United States amounting to something like a billion, and their building programs are practically double those of last year, which activity would exist in Canada if the public could be brought to the realization that the present level of building costs is here to stay and they must come up to that level. There is reason, he continued, for the high cost of material when we look at the 60-70 per cent. advance in workingmen's wages during the past few years and, after considering advances in some of the other lines, he was of the opinion that the building industry had been very moderate in their demands.

Following Mr. Armstrong's remarks three of the older members of the Exchange, Messrs. Wm. Forbes, Edward Gearing and John Aldridge were presented with life memberships in the Exchange, and after the singing of "For They Are Jolly Good Fellows," by the members, each of the three recipients briefly thanked the members.

Certificates were also granted to Messrs. John Wickett, James Crang and W. J. Davidge, "in absentia."

The Open-Price Scheme of Tendering

The chairman then called on Mr. Dillon to introduce Mr. McIntyre, president of the Electrical Contractors Association, of Toronto, who outlined the Open-Price system of tendering, as adopted by his association. Mr. McIntyre described the working of this plan in detail and its purpose, which is to do away with all unfair competition in tendering. The scheme, though not adopted by all the electrcal contractors of the city to date, has been put into practice by some of them, and has done everything claimed for it. The scheme, Mr. McIntyre stated, was worthy of a trial by all lines of the building trade.

Mr. Fraser, chairman of the Re-organization Committee, appointed at the last meeting of the Exchange for the purpose of considering ways and means of bringing more members into the Exchange, was next called upon to report the progress made. Mr. Fraser stated that there was not much to report along this line as yet. He stated that it was his committee's aim to get the different branches of the construction industry represented in the Exchange, when, he stated, the membership would increase automatically.

The chairman also spoke a few words on this point, suggesting that the members all combine to develop the Exchange and not leave it to a certain number to attend to this matter. He could see no reason why any member of any branch of the building business should not be a member of the Builders' Exchange. Mr. Dillon, speaking on this question, called the members' attention to the splendid work of the Exchange and what it was doing for its members, and urged the members to co-operate for its development. Mr. Carswell, of the General Contractors' Section, spoke at some length on production and conditions in labor circles to-day. After some discussion on the question of taking membership in the A. C. B. C. I, a motion by Mr. Dillon, seconded by Mr. Scott, that the Exchange take a membership in the A. C. B. C. I. was carried.

Resolution on Housing

Mr. Gander and Ald. Phinnemore discussed resolutions for the approval of the members which they proposed submitting, through a committee to be appointed for that purpose, to the Board of Control of the city, which pointed out the advantages of letting the building of workmen's homes to legitimate builders. There was some discussion on these resolutions, after which Mr. Fuller offered for the meeting's approval a resolution which carried. Mr. Fuller's resolution, in effect, was: That this Exchange recommend to the City Council that they have their Architect's Department draft the necessary plans for a housing scheme and that members of this Exchange offer to erect all such houses at actual cost, plus the sum of 5 per cent. That this Exchange also point out that its members have the necessary organization and equipment to undertake this work; that they have a knowledge of the necessary buying and the facilities for purchasing the material which will enable them to carry out such a housing scheme at lower cost than it can be carried out by the proposal advanced by Mr. Gunn, and turn out a more satisfactory job at the end of the proposition." It was moved and seconded that a committee be appointed to incorporate this resolution and take the matter up with the Board of Control.

The meeting was well attended and the members enthusiastic. The coming year promises well for the success of the Toronto Exchange.

Time and Cost Keeping on County Roads

Essential Features of a Proper System—A Check on Efficiency of Foremen—Weekly Reports to Superintendent

By K. W. McKay*

It is said that familiarity breeds contempt, and while comparisons are sometimes odious, it is desirable to have some idea of what road improvement and maintenance is costing in the various counties. From the municipal point of view, provincial subsidies cover up a lot of overcharges, extravagance and mismanagement.

The principle behind all of our municipal legislation is co-operation for the equalization of opportunity and expense. One of the first acts of the parliament of Upper Canada was in reference to statute labor, which is a compulsory system of co-operation in improving roads. This was followed by the toll-road idea which became unpopular as soon as townships or municipal co-operative areas were established. The tendency in recent years has been to place more responsibility on the counties and the province. The recent grant of federal aid completes the utilization of the expense of highway improvement. Within the next few years, the populous centres of Canada (and Ontario in particular) will be participating in the benefits to be derived from high-class roads. A general demand will then arise for direct contributions from townships or property-owners benefited by the construction of improved highways to a greater extent than is now provided for.

County road expenditures are levied on the equalized values of the local municipalities. The county road superintendents have important duties to perform in the distribution of county levies and provincial subsidies. They should see that both the county and province gets value for moneys expended.

Comparison of Results

There should at all times be a reasonable comparison in the cost of similar work in different parts of a county, and reports to the provincial department should assist in comparing results throughout the province. Highway improvements is a large undertaking; county superintendents are entrusted with a greater responsibility than any other class of municipal officers. They must adopt every idea leading up to greater efficiency, if they are to retain the public confidence.

A cost system must be one that will appeal to the superintendent. It should not be too elaborate or intricate. Those who have had experienced in other fields of work know the importance placed by large contractors on their cost system and the technical staff employed to maintain it.

A foundation for a uniform system of cost-keeping is desirable. The county roads should be divided into patrol districts, which should be subdivided into smaller construction sections, all to be numbered for reference. This classification of the road area should be entered in a suitable book with particulars as to location of culverts, bridges, hills, etc.

Experience suggests that county superintendents may not appreciate the importance of this record, and that the Highways Department should be interested to the extent of supplying uniform books to be completed in duplicate with the assistance of the inspecting engineer or an officer appointed for the purpose.

Weekly Reports from Foremen

As construction or maintenance work is performed, the superintendent should receive weekly reports from his foremen giving time and how employed, together with particulars that will enable him to determine the following:

1. Cost per mile for scraping with road grader, split log drag or other implement.
2. Cost of gravel or stone per load delivered on a road, with source of supply, length of haul and wages paid.
3. Cost of weed-cutting.
4. Cost of cleaning ditches.

In connection with the cost of culverts, the size, class of construction and depth of fill should be noted, and in addition—for bridges—the height above the stream and work on approaches.

In constructing roads, particulars as to grading, rate of wages, metalling, rolling per mile of road-bed or surface material, will be valuable.

Proper records of the labor and material utilized in oiling roads will popularize this efficient system of maintenance.

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*County Clerk, Elgin County, Ont., before Conference of Ontario Road Engineers and Superintendents.

Railings should cost the same per rod in different parts of the county, and where the cost of tile drains differ, the particulars should be included.

The wear and tear on machinery forms an important overhead expense, and a record of first cost, maintenance and service will be most valuable in preparing estimates including renewals.

Check on Efficiency

A cost system is an excellent check on the efficiency of foremen. It is the ultimate test of good organization. It will enable a superintendent to meet criticism with facts, and maintain his position in submitting estimates.

It is not intended that all cost particulars be entered in the book above referred to; cards printed to suggest the information required should be used. These may be carried by the superintendent and kept in a card index in his office. The cost of permanent culverts, bridges and other work, when completed, should be entered in the book.

As already suggested, the foundation of a cost system is a proper report from the foreman in charge of the work. The form known as the Maintenance Foreman's Weekly Report will be more within the comprehension of the average patrol man, and may be substituted for the time-book or larger pay-sheet. When combined with the individual cheque system of payment and suitable voucher form, this will do much to assist in the business-like administration of road improvement expenditures. Last year it was expected that something would be done to secure more uniformity in county road bookkeeping. There is every necessity for this. The superintendents and treasurers all have ideas. A comprehensive report on the whole question should be available.

Concrete Blocks Adaptable for House Construction

Report of Committee on Concrete Block Houses To National Conference on Concrete House Construction

In block, brick and structural tile made of concrete, we have three building materials which have survived the most severe criticism and prejudice of their earlier years. Houses constructed of concrete building units more than a score of years ago are still standing and to all appearances are practically as good to-day as when erected. The durability and stability of this type of construction has been proven conclusively by these earlier houses.

Having withstood the acid test of criticism, concrete building units are now recognized for their true worth as structural materials. Manufacturers have accepted all criticisms as constructive and by constant effort to improve their product have acquired considerably more skill in making these units than the pioneers in the business.

Vie With Other Materials in Appearance

The only valid objection which can be held against the earlier structures is their appearance. The effort to simulate cut stone has been the chief cause of prejudice. Had skilled artisans recognized the structural possibilities of concrete block when they were first invented and used their talent to direct the work, no doubt this objection would have been forestalled. To-day, concrete building units are being developed and manufactured which are unsurpassed by any other masonry material, either in regard to appearance or structural soundness.

Concrete building units are destined to occupy a prominent place among building materials. Because of their economy in manufacture and erection, and the low cost of up-keep, and on account of their insulating, fireproof and waterproof qualities, and owing to their permanence, attractiveness and adaptability to all classes of structures, whether built singly or in groups, they are rapidly assuming a leading place in the building material field. Concrete has been rightly termed "everlasting" and concrete building units may be correctly defined as "everlasting" building units. Time leaves no mark upon them as the years go by. They require the minimum of attention and repair and become stronger with age.

One of the outstanding merits of concrete building units construction is the insulation afforded by the air space in the wall. In making a hollow unit, the manufacturer has achieved a double purpose, he not only has reduced the amount of material that would be necessary for solid wall construction but has also furnished a good insulating medium. Houses constructed of concrete building units are comfortable at all times, cool in summer and easily heated in winter.

Speed of erection, a point always foremost in the minds of contractors and builders, is one of the chief advantages of these easily handled units.

An Outlet for Local Materials

One of the accepted practices of the building industry is to use those materials nearest at hand. Concrete aggregates, common to most localities, constitute the principal materials used. Thus the use of concrete building units reduce the demand on our transportation systems to a minimum.

Due to the plastic nature of concrete, building units made from this material are subject to a wide variety of architectural treatment and are suitable for all types of buildings, from a small and unpretentious home to a stately mansion. Already they have been used in extensive projects involving the construction of many homes.

So numerous are the treatments to which the surface of these units may be subjected that they may be used for the construction of every house in a city block without repetition of surface texture or color. The design of every house in a community may be varied with these flexible units without materially increasing the cost.

Wall Insulation Means Comfort and Money Saved

Protection of Walls Against Heat Transmission Will Make Concrete Houses More Popular

By Noland D. Mitchell*

SINCE the dawn of civilization man has made houses to protect family and chattels from the weather and depredation. With succeeding ages or civilizations better and better protection has been afforded. Can we continue this progress? In view of the many improvements that are being made in all our arts we can readily imagine great forward strides in house building in the near future. Certainly some forward movement is needed when the loss by fire is now approximately $300,000,000 in money and hundreds of lives each year. And incidental to this fire-cost must be added the upkeep cost of our large standing army of insurance and fire protection forces. The fire fighter comes after the fire starts to limit it to as small space as possible and the insurance man comes later to distribute a part of the loss money to the more fortunate, taking no inconsiderable amount in fees for his service. Let us, in making our improvements, not overlook this monstrous thing now exacting such heavy tolls of our energy and resources.

Another phase of the situation is the growing scarcity of fuels. We have been, and are still, very prodigal of them. Now is the time to consider in an economic way what we can do to conserve our supply. If we can make houses that do not require so much fuel for heating we should at least investigate the possibilities.

One cannot deny that our better constructed wooden houses have been comfortable and, except against fire, have afforded reasonable protection for a comparatively short time at a low first cost. While our lumber resources are by no means exhausted it is becoming more and more uneconomical to build wooden houses. In making the change from the wooden house to types of more permanent construction we must select some kind that will provide as much or more comfort for the occupants.

Insulation Is Important

The unfortunate thing that we realize at once is that our common fire resisting materials of construction have a high rate of heat conductivity as compared to the more combustible kinds. The cold walls resulting from the use of these has had no small influence in retarding the change from the wooden house. This being the case is it not time to make some effort at the solution of the problem?

The maintenance of an even temperature in a house resolves itself into provision of adequate heating apparatus and a construction that will satisfactorily prevent rapid dissipation of heat through floors, walls and ceilings. It is just another phase of the problem that refrigerating engineers have found to be of such importance in their work, namely, insulation.

There is plenty of evidence that many builders realize the necessity of insulation against heat transference, but we are not so sure that an altogether satisfactory solution has been found. If the various improvements in cellular blocks, walls and the like that are being brought out are any criterion then we can say not.

Let us look briefly into what has been done and the results. Wood furring with lath and plaster on the inside was probably the first effort to avoid penetration of dampness and the condensation of moisture on the inside of the wall. The result as far as insulating against the heat loss through an eight inch wall was an improvement of approximately 15%. Where the wall block absorbed dampness from the weather the result was not so good for in general any porous material in moist or damp condition transmits heat much more readily.

Hollow Blocks Not Damp Proof

The hollow block was another development in the right direction. The total result was probably not so very different from the wood furring except that it provided no lodgement for vermin and no runaway for fire. The chances for dampness showing on the plaster were much higher however, and there is no doubt that passage of dampness through the withes of hollow blocks is responsible for a large part of the long fight that advocates of concrete house construction have had to make to keep in the business.

Other builders realizing that dampness cannot travel by capillary action across a space bridged only by thin metal ties adopted that system and at the same time realized an improvement of about 20% over the 8 inch solid plastered wall. Hollow monolithic walls give about the same or perhaps a little better protection. The matter of detail of construction of the hollow wall is apparently more troublesome, yet with some builders they are still favorites.

A system, not so much in vogue, has been the building of solid walls of lean cinder concrete facing it with stucco on the exterior and plastering the inner face, or where the temperatures justify it, furring has been applied.

Cinder Concrete Furring Blocks

Another use of cinder concrete has been in making furring blocks to face the inside of the walls. I have not been able to find any data on the relative merit of these. One recent system imbeds the porous block in the centre of a monolithic wall so that the inner shell may serve as the supporting wall for floors and ceiling and thereby not break the continuity of the insulating course.

Other developments such as multiple cell blocks with offset withes, various forms of opening to allow freer circulation, etc., have been improvements in both insulating value and saving of materials.

A very popular building block is one made solid with projections on the rear face to bond with like projections on the blocks laid up to form the opposite face of the wall. This gives a good bond and is a simple arrangement easily cast allowing a wetter mix than that generally used in block construction.

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*Structural Engineer, Supervising Architect's Office, U. S. Treasury Department, before National Conference on Concrete House Construction.

All these efforts have made an appreciable improvement over the solid wall type, but generally the air spaces provided have been unnecessarily large and allow connection currents within the closed space.

A comparison of the results obtained by some of the above with the results of refrigeration insulating has led to investigation in a general way what might be done by using concrete as the structural member of the wall and combining with it an efficient insulating material.

As a basis a monolithic concrete wall 4 inches in thickness with 1 inch of corkboard insulation has been considered. It is not the intention to say that either the 4 inch concrete or the 1 inch corkboard is an ideal. In actual practice the thinnest concrete that will give adequate service and any insulating materials of the requisite qualities for the work should be used. There are many insulating materials on the market and if a demand is created for still different ones then we may be sure that some resourceful manufacturer will soon be able to meet it.

Heat Conductivities

There is no perfect insulating material. Of the more common ones the heat transmission factor varies very closely in proportion to the density of the structure. The cellular ones such as wood, pith, cork, wool, etc., are best for house insulation. Any of these materials must be kept dry to give the best service.

The following table from "Mechanical Refrigeration" by Prof. Macintire of the University of Washington gives the heat conductivity of some of our common building materials. The table indicates heat conductivity per square foot per inch thickness per degree difference in temperature per hour.

1" Common brick	4.66
1" Concrete (1:3:5)	4.29
1" to 4" Hollow tile	0.625
⅞" lumber (tongued and grooved)	0.83
Air space (from 1" to 6" thick)	1.66
1" mineral wool	0.67
1" builder's paper	0.30
1" pitch	0.79
1" shavings (dry)	0.67
1" granulated cork	0.48
1" cork board (all cork, compressed)	0.26
1" cork board (artificial binder)	0.28
1" hair felt	0.31
1" indurated fibre board	0.42
1" compressed mineral wool board	0.33

For thicknesses of these materials up to 8 inches the conductivity is in almost inverse proportion to thickness. The effect of change of temperature on conductivity is very slight through the range of temperature required in house heating.

As a comparison of the 4 inch insulated wall with the two usual types of furred concrete walls the following is submitted from Heat Transmission Tables compiled by Wm. R. Jones of the University of Pennsylvania. The heat transmission factors are:

(1) 8 inch solid concrete wall with 2 in. terra cotta or wood furring and plaster 0.53
(2) 8 inch hollow concrete wall (two 4 in. thicknesses of concrete) centre air space and furring as above 0.38
(3) 4 inch concrete wall with 1 inch cork board 0.18

Assuming that we have a house 26 by 26 feet in plan, two stories high with 1450 sq. ft. net wall area, an average difference of temperature of 35 deg. for 20 hours per day would show the following amounts of coal burned to make up for heat losses:

(1) 53.65 pounds per day.
(2) 38.57 pounds per day
(3) 18.27 pounds per day.

Thus it is seen that the thin insulated wall would show a saving over the other types of 35.38 and 20.30 pounds of coal per day respectively.

Assuming that the conditions as above continue for an average of 150 days each winter and that coal will cost $12.00 per long ton the savings capitalized at 6% for a 30 year period would justify expenditures of $400.00 and $228.00 respectively for the insulated wall over the other types. Or to come back to the sq. ft. unit 27½ cents and 15.7 cents respectively.

The saving of materials in the thin wall can be computed readily and the saving in space occupied by the construction. If the same outside dimensions are maintained in the house, the floor space for the thin wall type would be approximately 11% more than with the usual types.

Increased Comfort to Tenant

The matter of increased comfort to tenant has not been given a money value but it would be safe to assume that from a commercial standpoint this would be far more than any of the preceding. Once a builder has established a reputation for making safe, satisfactory, comfortable houses, economical in maintenance, he can be assured that his services will be in constant demand and his profits can be larger as a consequence.

Considerable progress was made in Europe before the war in insulating dwelling houses and in this country a number of houses had been built using different types of the better insulating materials.

There are a number of insulating boards on the market now, several of which could be adapted to use in dwellings but for general excellence and suitability, when the cost of installation and insulating service rendered are considered the cork board will rank near if not at the top of the list.

The objection of expense may be raised at once but that cannot be so very much, if any, above our usual types of construction. Cork boards are selling at this time (February 19, 1920) for approximately 13½ cents per board foot in quantities. When it is considered that it replaces at once the inside furring at least half the cost of the material is offset. In the example given above the concrete saved would offset the other half of first cost.

This plea for insulating concrete walls is made for the purpose of pointing out some of the reasons why concrete houses have not been more popular in the past and suggesting a remedy to overcome one of the serious objections.

The formation of a western waterways association is being advocated by Mayor C. F. Gray, of Winnipeg, to encourage the development of waterways in the prairie provinces. As an example of what might be accomplished, says the mayor, the Saskatchewan river could be made navigable to permit the transportation of coal from western fields. This waterway, he points out, runs through an immense pulpwood area and a district which is rich enough in copper sulphite deposits to supply the whole continent with sulphuric acid.

Correspondent Gives Practical Views on Use of Canadian Building Materials in England

Editor, Contract Record:

I have read with a great deal of interest articles on the use of Canadian houses in England, and the following may be of interest, although written by a practical workman, who has spent his life among buildings in both countries. In the first place, all Canadian houses, whatever their type, are doomed to failure in England, just as English houses would meet the same fate here. To adopt Canadian houses to suit requirements in England would make them lose their individuality completely.

The shortage of houses there is very acute and we can assist them a great deal by introducing some of our ideas and methods, even to the extent of all wooden houses "for rural districts only," and also by introducing Canadian manufactured doors, windows, sash, etc., in standard sizes. B. C. shingles might also be introduced if the cost could be reasonable. With regard to these manufactured articles, I am of the opinion that much can be done and a large industry created for Canada, for with our methods here, I am confident they can be made cheaper by us than in England.

In England, brick is the recognized thing, even for inside partition walls, owing to the fact, as mentioned in one of the articles I read, of the danger of fire and also because long blocks in a row are prevalent. Taking into account the extreme scarcity of material, all wooden partitions can be substituted and Canadian doors, frames, etc., can be used. In order to do away with blocks, we might introduce houses in pairs and in so doing we would, in my opinion, be giving the people of England the class of structure they need and that is "veneered" houses. That is what is required in England today. Such houses can be constructed very rapidly and at the same time have the same effect as brick houses. I might mention that the reason houses are built in long blocks, from one end of the street to the other, in larger towns or cities, is owing to the high cost of land. In my opinion, building pairs, with a few scattered singles amongst them, on the veneered plan, would vastly improve the streets, and also make the houses healthier as well as cheaper than the houses constructed at the present time on the English principle. Vast quantities of material manufactured for this type of house would find a ready market there.

Now consider the general plan and we can form some idea of what is needed. No basements are required there and the foundations may be placed practically on the surface, by removing the surface mould, in other words, just so far under the surface as to stand on a solid foundation. The surface of the land "interior" is covered with about three inches of lime concrete to prevent vegetable matter growing beneath the floors. Their system of using 2 x 4 scantling joists on sleeper walls can be done away with—this is a common practice there. Instead, we may substitute joists of a proper size to carry the weight required.

The general layout of ground floor must include a scullery, which contains in it a sink, and a copper for washing. The ground floor must include a pantry and an outside W.C. The sliding doors or arched partitions would not go there in workmen's homes, but would, I think, be appreciated in houses of a better class. Thus we see that the general layout of the ground floor remains the same.

With regard to the first floor, we can improve with more clothes closets omitted there, and include a medicine cabinet in the bathroom. Taking all things into consideration, we cannot improve the interior except by a few small things as previously mentioned and the heating.

The exterior is where we can make many changes by varying the designs and making them more attractive in appearance, taking care to include the following: (1) A damp course below the ground floor; (2) a better class of paper around the framework and also a galvanized iron strip over all windows and doors. These are necessary, as the wet there is very penetrating and water will soak through the veneer brickwork and run down on the inside. The strip over the frame would turn up 2 in. against the wooden framework and project 1 in. on the outside of the brickwork with 2 or 3 cross joints left out to let the water run out. Verandahs are not greatly required there, nor very applicable, owing to weather conditions, but attractive porches may be included.

In all-wood houses, I have not much faith. That there are many old houses of this type I will admit, but the lumber used in them cannot be compared with lumber of today. The poor stuff builders here are compelled to use, together with the high cost, is certainly no recommendation. In addition to this it must be considered that in Canada the majority of these houses are owned by the occupier who is never tired of looking after it. In England, workmen's homes are owned by better class people as an investment and the upkeep cost is too much and nothing spoils quicker than wood if not kept painted.

If anyone interested in the Canadian lumber industry in England would form a housing company using Canadian products as far as possible, and build sample streets in various towns and cities, where the housing problem is most acute, it would be a good speculation in itself, apart from the industry it would create by English builders copying our example. The expense of creating a Canadian garden village, as put forward by Mr. Adams in the "Contract Record" of January 28, is unnecessary.

Toronto A. Moore.

To secure the standardization of municipal plumbing and heating regulations was the main object of the annual convention of the Ontario Society of Domestic Sanitary and Heating Engineers which met last week. There is a wide variation in the regulations of various municipalities under their local bylaws; and in rural municipalities there are no regulations whatever, nor is inspection of plumbing and heating installations provided for. York County is the only rural municipality in Ontario with a plumbers' by-law. A memorial was addressed by the convention to the Government asking that provincial legislation be brought down unifying all existing laws and making them applicable to the entire province.

"Beauty in architecture combined with utility is the ideal to be aimed at in bridge construction, and the future of bridge building depends a great deal upon the architect," stated Mr. Frank Barber, consulting engineer of Toronto, recently. "There must be closer co-operation between the architect and the engineer."

New Policy Needed for Handling Labor Problems

Collective Bargaining and Profit Sharing Plans Fail to Clear Away Difficulties—Employers are Faced with Grave Dangers — Boycott Must be Destroyed

By Dudley Taylor*

EMPLOYERS are compelled to face serious labor controversies generally with little notice and not much time, if any, for preparations. Such an employer, particularly if it is his first experience in such matters, needs to know from a practical standpoint his rights and his remedies. He wants to know the law and to what extent and how it is enforced. He needs authoritative advice and direction. In talking with employers and employees and considering their problems I have necessarily formed a few conclusions and I regret to say that they are not favorable to labor unionism. The unwarranted injuries inflicted by labor unions upon those who do not yield to their demands are many, serious and exceedingly grave, and employers are forced to accept them.

Labor Problems an Unpopular Topic

The public attitude particularly is to be deplored; it seemingly is not minded to cast off its lethargy and acquire understanding. To most people labor trouble is a mental trouble—it is a disagreeable topic for conversation, and as such is to be put aside and avoided. Perhaps it is not surprising that people are loathe to put their minds upon such problems, but it is nevertheless to be deplored. The purposes and methods of labor unionism ought to be well understood and people should make it their affair to understand them, for the people in the long run are all affected.

If our newspapers would give space to a considerable part of the unlawful undertaking and practices of labor unions it would go far to clear the atmosphere. Our statesmen and leaders of public thought, if they would inform themselves and courageously handle the subject without gloves, could do much to clarify public opinion. But these things are not done. The newspaper which prints the truth, or at least very much of it, upon this subject is called a trust or capitalistic sheet and is boycotted as such.

The politician, big or little, who criticizes the methods and demands of labor unions is denounced as a standpatter, a reactionary and worse, and is openly threatened with political defeat. And the attitude of the business man himself, taking it all in all, is not particularly creditable. He is so intent upon running his business that he is blind to what the labor unions are doing until he himself is affected and is face to face with unreasonable demands and unlawful interferences, and then he wonders how such things can be and why they are tolerated, and why the law is not enforced. His eyes are finally opened and he sees that the fight which he is called upon to make is in a large sense not alone his fight but is the fight of all business and industry and that vital principles are at stake.

Now, what has been the result of this indifference? If I were going to ask and leave with you any one question I think it would be: "What is your stand upon labor unionism and what are you going to do about it?"

Labor trouble, which means labor unionism, is an incident to business. If you have not had it as yet you have been fortunate. But you will not always be so fortunate, and you are bound sooner or later to have your experience with it. In a narrow sense you are interested in it when it immediately affects your business, but in the broader sense you are interested as one of the public which must necessarily be affected, and as a citizen of this great republic which, as Abraham Lincoln pointed out, had to engage in a great war to see whether that republic should endure, and which may yet have to engage in another great struggle to demonstrate that minority and class organizations shall not rule.

Purposes and Methods of Unionism

What are the purposes of unionism? Principally they are to raise wages, shorten hours, restrict output and monopolize industry.

What are the methods of unionism? To strike and force strikes; to picket; to boycott; to threaten and assault non-conforming employees; to ostracise independent workmen and their families; and to threaten and bulldoze those who make and enforce our laws.

What is the power of unionism? Ability to force a multitude to pay dues, thereby creating and maintaining huge funds with which to carry on their warfare; unceasing propaganda, particularly among the illiterate, and finally, ability to coerce and force employees to quit work at the behest of agitators.

What is the effect of raising wages, shortening hours and restricting output? Why, it increases the cost of living and diminishes the supply of goods for consumption. Apparently the average union man does not reason in comparison. He does not compare his lot of today with his lot of ten years ago and ask whether he has bettered himself. His wages have doubled in the last five years, but his wages today will not purchase any more for him than his wages did ten years ago. And if wages increase and output is restricted in the future as they have been in the past his wages ten years hence, though doubled or trebled, will buy no more for him than they do today or did ten years ago.

Heretofore the workman has seemed blind to this fact, and has seemed to regard each raise in wages as a victory or gain, and has given his union credit for it. The increase in wages which his union forced put him "on top of the heap" for a short time only and he soon found himself on the wage level and then below the wage level where he continued until his union again boosted the wages. He did not realize that he could not always stay on the top, that other unions would do as his had done, and that he, as shown by his cost of living would have to pay for the increases in wages exacted by those other unions. There are some indications now that he is beginning to understand and appreciate this fact. Perhaps he does not yet realize that shortening hours and restricting output must invariably increase his cost of living, and that he, like the rest of us, is doing his part in paying the fiddler.

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*Associate Counsel, League for Industrial Rights, Chicago, before National Conference of the Associated General Contractors of America.

Building on an Artificial Basis

And where is the wage raising, the labor shortening and the output restricting to stop? You gentlemen are interested in building operations. You know the cost of building materials and the cost of building erection is today almost prohibitive. Even the modest cottage or bungalow of the ordinary workman costs thousands of dollars, where a few years ago it cost hundreds. Building in Chicago, and for that matter elsewhere in the country, has for these many years been upon an artificial basis as to cost and the unions are practically responsible for it. For years the building unions in Chicago have increased wages, shortened hours and limited the amount of work that might be done in a day and have hedged construction about with all manner of restrictions. They have prevented competition among workmen and have made it impossible on the part of employers. They have gone on the principle of having their members do as little and charge as much for it as possible.

If my memory serves me right, reinforced concrete construction, when it first came into general use a few years ago, was much cheaper than steel construction because the work was largely done by unskilled workmen, and for a time there was much reinforced concrete building projected and done. The structural iron workers considered the reinforced concrete workman as a serious competitor, and being unwilling to meet that competition they assumed jurisdiction over workmen in reinforced concrete, made them come into their union and arbitrarily doubled their wages. In that way they prevented to a considerable extent the use of reinforced concrete by making it cost as much or approximate in cost the steel structure. These unions have also indulged in jurisdictional strikes and have prohibited and prevented the employment of independent workmen in building operations. Whenever they have discovered a bit of work done by the independent workmen they have compelled the owner to take it out and to submit to extortion in the shape of so-called "fines."

"Licenses" for Employers

There are unions with small memberships which have complete monopoly over certain crafts or employment, and will not admit new members and permit work to be done by workmen coming from other cities even though such workmen hold union cards. They even presume to issue a "license" to employers to employ workmen from other cities for limited periods, and such periods and the license fees to be paid are determined by the unions in question. These unions are among your building trades.

You also have unions in your line which seek to close certain cities not only to outside workmen but to materials manufactured outside, and some of them form rings with employers to hold up the price of labor by preventing out of the city workmen and materials from being employed and used. In such instances the employers' ring is dependent upon the union ring to enforce its monopoly, and the union's interest in the matter is to enable the employer's ring to have such a monopoly and make such a profit that its members can afford to pay the wages and meet the other demands exacted by the union.

Strike of Steel Fabricators

Just now we have in this city a strike which has been in progress for several months past involving steel fabricators. Steel fabricators are shop men, and do not do work outside of the shop. They recently announced that all fabricators must be members of their union. The employers resisted. A strike was called and the shops were picketed. When this did not bring the employers to terms, the teamsters and chauffeurs' unions were influenced to put a ban against all hauling to and from the shops. And when this boycott did not force the employers to yield, the structural iron erectors were ordered not to erect any of the material fabricated in these shops. And there the matter stands today. The teamsters will not haul and the erectors will not erect steel from these shops. This is a plain boycott and conspiracy, and as such should not be tolerated.

Picketing Never Peaceful

Some courts have indulged the theory that picketing may be peaceful and lawful. The courts in Illinois have held that all picketing has elements of intimidation and is annoying and interfering and unlawful. I submit that the Illinois view is amply justified by the facts. I have interviewed hundreds of workmen on the subject of picketing. It is idle to tell them that pickets are not antagonistic but are simply there for persuasion or to furnish information, and that the employee may act as he sees fit. They regard pickets as emissaries of a hostile organization and they realize full well that they must not take work or continue at work contrary to the wishes of the pickets and the union which they represent.

The methods employed by pickets are well known to them because picketing has acquired a reputation for violence and various interferences with the liberty and rights of individuals, and they fear pickets, and this fear is justified, even though pickets appear to be peaceful and even though they say nothing. There are innumerable instances in which employees have been singled out, their addresses obtained and later such employees have been assaulted, frequently and generally at considerable distances from their places of employment and under such circumstances that the assaults could be accounted for only on the assumption that the peaceful pickets had reported the addresses and routes traversed by such employees, to those who arranged for the assaults.

Upholsterers' Strike an Example

In the present upholsterers' strike, which has been in progress in Chicago for the past several months, there have been a great many instances of assaults by groups of thugs, and the homes of several of the employees and some of the factories have been bombed. And yet the union insisted that its picketing was peaceful. Give the workmen a choice between employment in a factory which is peacefully picketed and a factory which is not picketed, and you can guess which factory he will work in. These assaults have been so common that they no longer attract any attention, and the public instead of demanding that the law be enforced, has become callous.

I have cited only a phase or two of picketing, and time forbids going into further details. But I deny that picketing is non-intimidating and non-coercing and lawful, and I assert from abundant knowledge upon the subject that it is intimidating, that it is coercing, that it is a wrongful interference with the rights of employer and of independent employees, and that it is unlawful. And I challenge anyone to show a legal or moral justification for it. I submit and insist that when persons quit their employment they have absolutely no right to picket and seek to influence other persons not to enter or continue in the employment of the firm whose services they have left. When they engage in such picketing it is a species of warfare upon the firm to interfere with and disrupt its business for the purpose of coercing it to submit, and that is unlawful and morally wrong.

The Boycott is Wrong

But what about boycotting? And first, what is a boycott? A labor union boycott is a combination of the many to injure one or a few firms for the purpose of coercing and compelling such firm or firms to yield to the union's demands. Now, if the firm or firms were manifestly wrong and had been clearly unfair to their employees, the public might feel that the boycott was in a measure justified and resulted in a rough sort of justice. But suppose that the employer is not in the wrong, and that the union, as frequently is the case, is wrong, then, is the employer to get justice?

Some seem to hold the theory that the public will judge of the merits of the boycott and will do justice. It has been my observation that nothing is farther from the truth. The public will not trouble itself to investigate. It will not take the time to inquire and inform itself and act upon its information, and give or withhold its patronage accordingly. On the contrary, the public will avoid any loss of time or trouble. It will steer clear of the matter. Given its choice in determining on a place which is picketed and boycotted and one which is not so picketed and boycotted, generally speaking, it will avoid a picketed and boycotted place. It does not wish to take sides. It does not wish to submit itself to unfavorable criticism and possible penalties in the way of similar discrimination or injury. Therefore the boycott which is aimed to interfere with patronage by picketing is simply a case in which a union sets itself up as the judge, jury and executioner. And unless the boycotted party can get quick and speedy relief through the courts he is likely to suffer great injury, if he is not financially ruined.

What Are the Suggested Remedies?

What are some of the remedies and cures that have been suggested? First, there is arbitration. But unions will not arbitrate unionism, and the employer has a right to operate, a non-union or open shop if he so desires. Unions, with a few exceptions, are unincorporated, and cannot be made to respond in damages, and are not easily subjected to the law. Inasmuch as they cannot be legally controlled, or are not legally controlled, arbitration of awards have invariably or almost invariably, been nothing more than concessions in which the demands of unions are wholly or partly met, and have resulted in increased wages, shorter hours, and other terms demanded by the union. Until arbitrators can enforce their rulings against labor unions and compel labor unions to abide by awards which are unfavorable to them, arbitration will not afford a just settlement.

Some there are who advocate collective bargaining, but they do not define the term. It generally involves recognition of and dealing with the union, making such terms with the union as the union will accept. If the bargain is not accepted by the union it means a break with the union, and going on a non-union or open shop basis, with the union as a persistent adversary. As was said not so very long since by the United States Supreme Court in the Hitchman Coal Company case, collective bargaining which is not voluntary on both sides is no bargaining at all. And I think that we may properly go further and say that a bargain which is merely a concession and which when made cannot be enforced, is no bargain.

Some advocate division of profits or profit sharing. Many employers have tried this and have found the results wholly unsatisfactory and so discouraging that they have abandoned it. They have found that it is not profit sharing in a true sense, but amounts to a guarantee of a certain amount which must be paid yearly even though the business does not sufficiently prosper to warrant it. Only by the payment of a sum equal to that first set aside as the workmen's share of the profits can the employer hope to satisfy his employees. What is called a profit sharing, therefore, becomes a bonus, and as such does not in the long run satisfy employees and prevent unrest. Looking ahead we may ask where the line is to be drawn in profit sharing, and who is to draw it. What is to be the share of the firm and what is to be the share of the employees, and who is to decide it? And will the employees ever be satisfied? Will the system work?

We hear much these days about the workers having a voice in the industry and its management, and it is suggested that workers be elected to the directorate. This involves considerations that are somewhat similar to those involved in profit sharing, and one may well ask where the line is to be drawn, and who is to draw it.

An industry must be conducted upon a sound basis and that involves a power to direct, a power to control, and, of course, the power to discipline. And I submit that capital will not be employed where it cannot direct, control and discipline in order to maintain an industry or business upon a sound basis.

A Moral Awakening Needed

To me one of the distressing results of unionism is the lowering of moral tone among the workers, the hatred of the employer class which unionists foment, the determination that the end justifies the means and that intimidation, violence and the manifold interferences with clearly recognized legal rights are justified as a necessary element of industrial warfare. I regret to see politicians truckling to organized lawlessness and the evident fear and subserviency of some public officials, including judges, is anything but an edifying spectacle. I regret to see fine women who pose as uplifters actually countenancing attacks upon reputable business. I feel that we need a moral awakening; that it is high time that respect for the law and for the rights of others should be inculcated.

Our statesmen, those who through their exalted positions have influence with the public could do much to influence the public in these matters if they would courageously and without gloves discuss them. But you business men have it in your power to accomplish much. You must take in interest in politics. You should know your legislators. You should know those who represent you in your home districts. You should see that business men are chosen, and to do this you must engage in party affairs. And you should then note the conduct of your chosen representatives. You should uphold their hands when they stand for what is right. You should give them your continued support if their record justifies it, and you should withhold your support if their record does not justify it.

All of this is based upon knowledge and you must be at pains to inform yourself. Interview your fellow business men. Inform yourself and use your influence to select the right sort of representatives. They make the laws under which you live and do business.

I have endeavored to tell something of the purposes, methods, powers and results of unionism. Is it safe to deal with unionism which seeks to rule or ruin? In closing, I urge you to come to a realizing sense of the grave problems involved in unionism, to do what you can, to see that others appreciate what is involved in the union movement; to interest yourselves in politics and public questions, to the end that the best men are selected and supported for political preferment; and to do all that you can in these and other ways to build up the moral stamina of the people and see that the law is respected.

Surface Treatments on Macadam Roads

Past Trouble Due to Attempts to Salvage Pavements That Are Too Far Gone or That are Subject to Too Heavy Traffic

By Philip P. Sharples*

MUCH of the dissatisfaction with surface treatments on macadam roads has arisen not through any fault of the system but on account of the attempt to salvage pavements that have gone so far that they could not be retrieved by so simple a method, or where they were subjected to traffic that called for a heavier duty type of pavement. It was the engineer's judgment that was at fault, not the method.

The choice of the bitumen too has often been at fault. Dust laying oils and raw tars have been confused with the more permanent refined tars and asphalts which alone will be considered here. Dust layers simply weight the dust particles and prevent their blowing about. The heavier bitumens prevent dust by binding and protecting the road surface, either by penetration into the road crust or by forming protective mats of bitumen and stone upon the surface.

Many of the old macadam pavements have worn thin or have ground up internally under traffic weights that they were not designed to carry. Obviously in theory but seldom in practice, these old road crusts should be strengthened and drainage errors corrected before successful surface treatments can be expected. With soft rocks it may even be necessary to strengthen the crust by employing some of the modified penetration methods, using the thinner tar or cut-back asphalts applied cold.

Surface Treatments for New Macadam

Where new macadam is built, it should be so constructed that surface treatments can be successfully applied soon after or even before the road is opened to traffic. The old tenets of good macadam construction are too well understood to dwell upon here. Suffice it to say that drainage and foundations should be good, that the design should be built of good materials, properly rolled and properly filled and bonded.

The surface must be given particular study. It must be remembered that the final surface produced is a bituminous surface. The contour should be therefore not that of a macadam road but that of a bituminous road. A camber of ¼ to ¾-in. is plenty. A greater crown than this makes a slippery road.

The material for the surface course should be carefully chosen. The stone should be as large as can be made to bond in place. For a soft stone sizes grading from 3 in. down to 1¼ in. are not too large. With trap rocks and hard stone, ¾-in. to 2-in. may not be too small, if the pieces of different sizes are well graded.

The kind and amount of bonding material are of great importance. Usually stone chips and stone dust of the same material as the stone used give the best results, but with soft limestones a graded clean gravel from ¾ in. down to ⅛ in. often gives superior results if intelligently used. The aim should be to thoroughly fill the voids in the stone by flushing in the filler with alternate watering and rolling until the surface is solid.

Extreme care should be observed to leave no layer or cake of screenings on top of the stone composing the surface. If any such layer remains it is often impossible to surface treat the road successfully. Clay and materials that produce slime should be religiously avoided in the top course as they form emulsions with bitumens and the coating sloughs off.

Aging of the Macadam

The aging of the macadam before it received the bituminous treatment has of late years been the subject of much study With the heavy mat coats, it is important that the macadam be thoroughly set up by aging before the application is made. The cementing value of the soils used, the traffic and moisture conditions, are factors in the setting up process. Usually, six weeks to two months in the spring and summer are sufficient. Pavements finished in the fall may be carried through the winter by using calcium chloride, and then the bituminous treatment given as early as practicable in the spring.

If cut-back bitumens, applied cold, are used, it has been found possible to greatly shorten the aging before the application, and even if care is used, to apply the bitumens on completion of the road. With soft rocks and rocks of low cementing value, new possibilities are indicated by these methods of early protection against automobile traffic. The refined tars applied cold have given particularly satisfactory results in this field and even where subsequent treatments have been made with asphalts, the first use of tar applied cold has been found advantageous.

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*Manager General Tarvia Department, the Barrett Co., before American Road Builders' Association.

Whether a macadam road is old or new it must be very thoroughly cleaned before surface treatments are applied. Brooming with steel wire rotary brooms followed by local hand work is good practice and care must be taken to clean the pavement down to clean stone. Caked material or dust on the surface prevents the bitumen from penetrating and from bonding onto the stone. Hot blanket coats require particularly thorough cleaning of the road. Sometimes a priming coat of cut back bitumen applied cold helps in forming a bond.

The choice of one bituminous material that can be used to solve all the surface treatment problems that arise is a manifest impossibility. The kind and grade of bitumen must be varied to suit the kind and the size of stone used in the road crust, the expected volume and character of traffic, and its distribution through the seasons and the climatic conditions, and in the face of all these variants, a choice of material and method is more often controlled by the funds available. It pays to make a close study of local conditions and to get the benefit of the combined experience in any locality.

Amount and Kind of Cover for the Bitumen

This subject offers just as interesting a field for study as the bituminous materials themselves. The choice is often limited to what is available locally, but given a variety to choose from, little chance of mistake is made in choosing the hardest material possible and in using the largest sized particles that will be held on the road by the bitumen. The amount used should be the least possible to protect the surface from picking up under traffic. It is better to add more subsequently than to use too much at first. A big excess wastes bitumen and may even destroy the coating by furnishing mineral aggregate in excess of the binding power of the bitumen.

Treatments of hot bitumens to be successful require good hard cover of the correct size. Unless this is used rolling and rutting are almost sure to occur. Stone as large as ¾ in. to 1¼ in. may sometimes be used to advantage.

As the cover and its application form a considerable part of the expense of surface treatment the economic cost factors should be thoroughly studied. Some bitumens require much more cover than others and some require more expensive cover. As this extra cost may be in part offset by greater durability, the problem should be viewed from every angle.

Re-treatments

Re-treatments call for special study as the conditions are essentially different from the first treatment. Usually little sweeping is required and the patching is a much easier matter or may even be deferred until after the treatment is applied. As a rule the quantity of bitumen required for re-treatment is much less than for the original treatment. The road is already saturated with bitumen and a renewal and enlivening of the surface is generally all that is required. A macadam which absorbed ½ gal. originally can usually be re-treated with ¼ gal. In subsequent treatments the amount may be still further reduced to advantage. Thickening of the mat is in most cases to be avoided, as it leads to rolling and rutting of the surface. Sometimes the same end can be gained by using a thinner bituminous material applied very sparingly.

The care and maintenance of surface coatings requires careful thought to make it economical and effective. No surface treatment should ever be applied unless provision is made for taking care of the surface. The introduction of cold patching materials has made the care of surface treatments much easier. Much is gained by patching breaks and abrasions as soon as apparent. For this reason patrol maintenance is particularly effective in taking care of surface treatments. Equally good results may however be obtained by gang maintenance with automobile equipment provided recurrent trips are frequent.

Surface Treatment of Gravel Roads

Surface treatment of gravel roads with anything more than dust layers may be said to be more or less in the experimental state. The distinct successes measured in permanence to date have been on gravel roads that to all intents and purposes were macadam roads. In discussing the question, the term gravel must be distinctly defined. The term is applied to a great variety of materials of differing sizes and mineral content.

In addition to variations in the material, gravel roads are built under widely varying specifications. No lasting surface treatments on a gravel road are possible unless the road as constructed is capable of sustaining the traffic that goes upon it. A surface treatment cannot supply drainage, a foundation, a base, or a thick bituminous wearing course. All that can be expected of it is to supply a protective coating that will conserve the surface from the abrasion of automobile traffic. Whether this coating is lasting or not depends wholly on the sustaining power of the structure.

Even if they are not lasting these treatments may be economically justified. Gravel roads in the northern states when well built and properly maintained are never out of condition more than one month of the year, and that is in the spring when heavy hauling of any kind is usually out of the question in these districts. The lumber hauling is done on the snow and the crops are moved in the fall when the gravel road is at its best. The better road is hardly justified economically in many situations and yet something must be done to hold these roads against automobile traffic.

The untreated gravel roads of the glaciated states are of great economic importance since they may be built at a comparatively low cost and will sustain light traffic successfully. Traffic censuses on roads of this class show that they will take care of about 200 automobiles per day with the ordinary gravel maintenance methods of dragging and patrol. Beyond this traffic the surface becomes loose and the disintegration of the surface becomes serious. Dust laying oils alleviate the dust nuisance, but the oil destroys the natural bond of the gravel and causes much potholing.

Will Carry 3000 Vehicles Per Day

In Maine and New Hampshire a system has been worked out using cold refined tars that enable these roads to carry 2,000 to 3,000 automobiles per day through the summer season. For the winter and spring the road crusts may break up, but as the traffic on these roads at that time is extremely light, and not of a heavy loaded type, it militates little against the success of this type of road and the surface treatment.

For the first treatment the road is dragged into good condition in the spring, with addition of new gravel if necessary. Application of sufficient gravel to amount to more than 2 in. should be made in the fall. After the road has dried out and hardened under traffic, it is swept with horse brooms and the first application of cold refined tar applied. This is allowed to soak in without cover. A second treatment is then given. This is left without cover for 4 to 6 hours of sunshine and then if any liquid remains on top, enough cover is used to blot up the excess.

Patrol maintenance is given these roads and is necessary to economically maintain them. All bank gravels run uneven, so that dust pockets exist in these roads which sooner or later break out. The breaks are easily repaired with tar and gravel, if attended to immediately, but if neglected spread and threaten the whole road.

The roads may or may not break up in the winter, depending on the road and the weather. After hard winters such as 1917-18 they do not break. After open winters like 1918-19 the road usually breaks when the frost is coming out of the ground. In case the road does not break, it is repaired and re-treated like a macadam road. In case the road breaks, it is shaped up and dragged back into condition like an ordinary gravel road. In either case, a single re-treatment of ¼ gal. per square yard is usually sufficient to put the road in good shape for the season's traffic.

If the road goes through several seasons without breaking up, it is usually necessary to break it artificially as the road through frost action and heavy traffic gradually loses its shape. A road roller with spikes in the wheels, a steam scarifier and a harrow are effective tools on this work. After the road is re-shaped it is re-treated and maintained as before. However, as the gravel is stuck together in lumps, the road acts more like a macadam and will go a much longer period before it requires breaking a second time.

Schedule of Engineering Fees

THE accompanying abstracts from various proposed schedules of fees for engineering services are of considerable interest. They were compiled by Baar & Cunningham, engineers, Portland, Ore., and published in the "Architect and Engineer."

American Institute of Consulting Engineers—A per diem rate of from $100 per day upward is proposed. On a percentage basis 1½ to 3 per cent, is allowed for preliminary surveys, studies and reports. For preliminary surveys, etc., with the addition of detailed plans and specifications, 2½ to 5 per cent. For preliminary work, plans and specifications, and general supervision during construction, 4 to 5 per cent., or higher on small jobs. For full professional services, including detailed inspection and management, 6 to 10 per cent. or more.

The Pacific Association of Consulting Engineers—The minimum per diem rate of this association is $50 per day. The percentage fee for preliminary studies, working drawings, specifications and contracts and general direction of the work is fixed at a 5 per cent. minimum. No suggestion is made for full professional services, including inspection.

Civil Engineers' Society of St. Paul—A percentage fee for a preliminary report with general plan and estimate of cost is fixed at ¾ per cent. For complete plans and specifications, including preliminary report and survey, but exclusive of soundings and borings, the fee is fixed at 3½ per cent, for work costing less than $10,000; 3 per cent. for work costing less than $50,000. For consulting superintendence, the charge is 2½ per cent. of the cost of the work. This does not include inspection.

Mahoning Valley Ohio Engineers—The per diem rate is $25 per day. Per diem rates are also fixed for the services of assistants of various classes On a percentage basis for sewer work, including engineering and supervision, 8 per cent. is charged for the first $15,000, and 7½ per cent. for the second $15,000 of the estimate. For paving work, 7 per cent. is charged for the first $15,000, and 6½ per cent. for the second $15,000. The client is to pay for one inspector on percentage work. It would appear that the intention is that these fees are to cover simply general supervision, but not inspection.

Iowa Engineering Society—The per diem rate is fixed at $15 to $25 per day. The percentage rate for preliminary services is 1½ per cent for these services and in addition the preparation of drawings, specifications and contracts, and letting the contract, 2½ per cent. For all preliminary services, and also consulting supervision of the work, 5 per cent. For full responsibility, including inspection and all engineering services, 6 per cent.

Edmund T. Perkins, Paper Before the Illinois Society of Engineers—This is an elaborate schedule, and proposes a sliding scale for charges on work of varying magnitude. The fee for full professional services, including superintendence, varies from 12½ per cent. for jobs of less than $5,000, to 4.2 per cent. for jobs of over $500,000. These percentages do not, however, include inspection. The statement is made that, "A schedule rate for superintendence applies when the engineer who has designed and planned the work, or his assistant, superintends construction. All other employees than such assistant or assistants are to be paid by the owner."

Connecticut Society of Civil Engineers—The percentage fee for preliminary conferences, estimates, and reports is from 1 to 1½ per cent. For these services and plans and specifications, 2½ to 5 per cent. For all preliminary services and general supervision of construction, from 4 to 8 per cent. For full professional services, including inspection, from 6 to 12 per cent.

The village of Port Dalhousie, Ont., is making a move to get a waterworks system, and it is likely the supply will come from St. Catharines. When the big pipe line from Lake Erie to Lake Ontario is finished, work on which is to be commenced this spring, all places along the Welland Canal will get their supply from Lake Erie. The digging of the new Welland ship canal is destroying their source of supply, and the government is building the pipe line, which will cost several million dollars.

There has been delay in two of the provinces in adopting the federal housing grants. but it is expected that legislation will be adopted in these shortly.

No. 13

Canada's Contractors—C. R. Holmes

For our "Canada's Contractors" section this week we have selected Mr. Chas. R. Holmes, president of Fred. Holmes Sons, Limited, general contractors, of Toronto. The firm, of which the subject of our sketch is now the head, was established a great many years ago by Mr. Fred. Holmes, Sr., and carried out many of the outstanding pieces of construction work in Toronto. Mr. C. R. Holmes started in the general contracting business in 1902, with his father, Fred. Holmes, Sr., becoming a member of the firm in 1907. Upon the re-organization of the firm as a limited liability company in 1910, he was elected secretary-treasurer. The firm at that time became known as Fred. Holmes and Sons, Limited. On the death of Mr. Fred. Holmes, Sr., in 1916, Mr. C. R. Holmes became president. He enlisted in 1916, going overseas in March, 1917, serving as lieutenant in the 2nd infantry battalion in France, Belgium and Germany. In the meantime the firm suspended operations, as all its active members were overseas. On Mr. Holmes' return to Toronto in May, 1919, a renewal of the firm's charter was applied for and business was resumed. The company have many important buildings in Toronto to their credit, including the grand stand at the Canadian National Exhibition; the Canadian General Electric Company's office building, corner of Simcoe and King streets, Toronto; the north wing of the library of the Provincial Parliament Buildings, Toronto; the residence of the Lieutenant-Governor of Ontario, Chorley Park, Toronto; Shea's Theatre and Shea's Hippodrome, Toronto. Mr. C. R. Holmes has associated with him in the business his brother, Mr. Fred. Holmes, Jr.

Mr. Chas. R. Holmes

National Safety Council Meeting to Consider Relation Between Safety and Engineering

A NUMBER of the engineers who are foremost in accident prevention work and in engineering education are on the program of the first spring meeting of the Engineering Section, National Safety Council, to be held in the Engineering Societies Building in New York City on April 27. The relation between safety and engineering and the engineer's place in the modern industrial world will constitute the motif of the entire program. C P. Tolman, Chairman, Manufacturing Committee, National Lead Co., and Chairman of the Engineering Section will preside

The detailed program follows.

The Relation of Safety to Engineering Efficiency —L. A. DeBlois, Manager, Safety Section, E. I. du Pont de Nemours & Co., Wilmington, Del.

Safety Instruction in Engineering Colleges—"The University of Illinois Plan"—Paper by B. W. Benedict.

How to Interest Student Engineers in Safety—Professor G. S. Blessing, Department of Engineering, Swarthmore College, Swarthmore, Pa.

Afternoon Session

General Subject: Safety Standards.

The Movement for Uniform Safety Standards and the Engineering Section's Part—David S. Beyer, Vice-President and Chief Engineer, Liberty Mutual Insurance Co., Boston, Mass.

Proposed Standards for Guarding of Belts, Gears, and Other Power Transmission.

Evening Dinner

Subject: The Engineer's Place in the Modern Industrial World.

Guniting Deteriorated Wood Piles

IN a railroad trestle extending beyond shore line the four-pile wooden bents were considerably deteriorated below the high water line and have recently been reinforced and protected by cement mortar applied by the gunite process. The method is described in "Public Works."

A mixing machine, cement gun, and supply of sand and cement were installed on a flat car followed by another flat car equipped with motor driven air compressor, pressure tank and fresh water reservoir. The gunite was applied in a thickness of about 1/16 inch to 8 inches dependent on the condition of the piles, and wherever large holes had been eaten by marine borers they were covered by wire netting and the piling was brought up to normal size and in all cases was protected up to above high water level. Short piles were treated at the rate of almost one pile per minute and after 7 days it was difficult to break the gunite even in the thinnest places with continuous pounding. The work was executed by a gang consisting of 1 man that handled the sand and operated the motor, another that handled the cement gun and served as conductor of the train, two men to feed sand and cement to the mixer, one man delivering the mixture to the gun and one man to operate the gun, besides a machine tender and a helper, and three men to handle the hose and nozzle.

Hints for the Contractor

That May Save Him Time and Money—We Will Pay for All Accepted Items—Send One In

Transformer Oil Proves Cheap and Effective Anti-Freeze in Motor Car Radiator

By F. Keith D'Alton

CONTRACTORS who use motor cars or trucks either for personal use or for haulage purposes are frequently obliged to tie them up during the winter unless some effective non-freeze liquid is used in the radiator of the engine. Many of the commercial preparations are expensive and some of them injurious; others, again, do not prove economical on account of their rapid evaporating properties. The writer has been making some experiments with transformer oil and here records his experience for the benefit of those interested:

Transformer oil is the cooling and insulating fluid used in electrical transformers. It is a mineral oil obtained from crude petroleum and is supplied in two grades, namely, light and medium, the light oil only being considered in this report.

The specifications for oil for transformers state that the liquid must have the following characteristics:

(a) Low viscosity.
(b) High boiling and flash points.
(c) Freedom from moisture, sediment and impurities.
(d) Chemical stability under local high temperatures.
(e) Chemical neutrality towards metals and insulating materials.

In addition to meeting the above specifications and a few additional requirements in the matter of electrical insulating properties, transformer oil has a heat capacity of about half that of water and will not expand at low temperatures.

When used as a cooling medium for the engine of a motor car during cold weather this oil gives very good satisfaction. It circulates nearly as freely as water, and although its heat capacity is lower the supply of cold air which is available, will fully compensate and the engine can be kept at normal temperatures while running.

A thermometer on the radiator cap is practically a necessity as an indicator of the amount of covering which the radiator requires.

When the car is allowed to stand for some time in cold weather this oil may commence to congeal. It does not freeze in the ordinary sense of the word. At temperatures of zero (Fahrenheit) and below, it thickens, but will not burst the radiator or engine water jacket. If the oil becomes quite thick it will not circulate freely on again starting the engine. This feature, however, does not cause any great difficulty unless the motorist should completely uncover his radiator and immediately proceed along the road into the wind. In this case, of course, the oil in the radiator is not given any opportunity to warm up and it will continue to block circulation. The remedy is simply to run the engine for a few minutes before uncovering the radiator; once circulation commences there will not be any further trouble until the car has again been standing for some time.

The boiling point of the oil is in the neighborhood of 300° F., and its flash point is about 430°. Therefore, it will be realized that evaporation at ordinary running temperatures (170° F.) is very slow, and that there is no danger of fire from the oil.

The oil supplied for transformers is required to be free from moisture, sediment and impurities and to be chemically stable at the local high temperatures of a transformer which are about the same as the maximum temperatures that occur in an automobile engine. Although some of these characteristics are required for electrical purposes, they are obviously good qualities in a cooling medium as they eliminate the danger of clogging the passages of the radiator with solid matter which may at first exist, or later be formed, in the oil.

The chemical neutrality toward metals and insulating materials is one of the best qualities which the oil possesses. It insures that there will be no injury (corrosion or dissolving) to the metal of engine or radiator or to the fabric in the gaskets or connecting hose.

Oil usually softens rubber, but a test which lasted through the recent winter has shown that the effect on the rubber in the hose is very slight and does not necessitate replacing either of the connecting pieces of hose.

Transformer oil appears to be a very good cooling medium for use in cold weather. Its characteristics seem to excel those of any of the commonly used anti-freeze mixtures; for, in that there is absolutely no danger from freezing nor appreciable loss due to evaporation it is ideal.

There are, however, two features which are not altogether in favor of the use of transformer oil in cooling systems. Firstly, having a very low temperature co-efficient of expansion, it cannot be used in any thermal siphon system, but requires a pump to effect good circulation, and secondly, where leaks in the cooling system have been stopped by rust or other chemical compounds, the oil may remove these and leak out. This not only causes loss of oil, but may allow the oil to spread over the surface of the engine, where, due to heat and exposure to air, it turns into a thin white smoke which comes up into the car and may be objectionable to passengers while the car is standing after a run. While running, however, there is no trouble from this source as the smoke is carried under the car by the passing air.

The cost of transformer oil is in the neighborhood of 65 cents per gallon.

The Maisonneuve Park Commission, Montreal, have accepted the tender of the Maisonneuve Quarry Limited, for crushing and extracting stone from Maisonneuve Park for a term of five years at $1.15 per ton. The contractor undertakes to excavate and crush a hundred thousand tons of stone each year.

Night Road Work Successful with Artificial Light

CARBIDE lights set on posts 4 ft, high spaced about 100 ft. apart, enabled night construction at reduced cost on the Hancock-Dollar Bay highway in northern Michigan. Construction began July 23 and as, after Aug. 1 in this latitude, night frosts are frequent and the warm hours during the day when tarring is possible are few, it was determined to employ night shifts so as to complete the work before cold weather. The shifts arranged were 4 a.m. to 1 p.m., 1 p.m. to 10 p.m. and 10 p.m. to 4 a.m. There was darkness only during the night shift and then for only four hours when artificial lighting was necessary. The construction was penetration macadam, 15 ft. wide in a 3-in. excavation on a 24-ft. roadbed. The night shift was employed exclusively in handling stone by motor truck and spreading it, and the force consisted of three trucks and drivers and one man helping to dump and spreading. The trucks averaged about seven loads each per shift with a four-mile haul. The carbide lights arranged as stated were moved along as the stone laying progressed. There was no traffic to interrupt, and T. A. Coon, engineer, Houghton County, states that the efficiency of the men on the night shift was greater and the unit cost less than with daylight work. So successful was the night work that it will be employed during 1920 wherever the occasion arises.

"Hydro" Using McDiarmid Rail Clamp

The Ontario Hydro Commission recently placed an order for 200 rail clamps, as illustrated, with the McDiarmid Positive Rail Company. The McDiarmid Rail Clamp is claimed to be a decided improvement over the old style clamp It is made of best cast steel, with a tool steel grip which bites the rail and positively cannot slip. This clamp takes up less rail space than any other clamp on the market, has no useless toggle, is extremely strong, though not cumbersome, is easily handled and quickly adjusted. The McDiarmid clamp will fit any rail. It is used chiefly for clamping steam shovels, wrecking and hoisting machinery.

The McDiarmid Rail Clamp

Soft Coal Storage

PREVENTION of spontaneous combustion and deterioration of bituminous coal stored in large piles may be effected, to a large degree, by observing the following precautions which are made in accordance with the conclusions drawn from official tests made by the United States Bureau of Mines:

Piles not to be over 12 feet deep, and no part of the interior to be over 10 feet from the surface.

Store only screened lump coal—if possible.

Keep out dust as much as possible, and to do this avoid handling.

Have lump and fine evenly distributed. Do not let lumps roll to the bottom and form air passages.

Rehandle the screenings after two months, if possible.

Store away from any sources of even moderate heat, and well away from the main buildings of the plant; never against a frame building.

Allow six weeks seasoning after mining before putting into storage piles.

Avoid alternate wetting and drying.

Avoid admission of air to the interior of the pile through interstices around timbers, irregular brick work or a porous bottom such as coarse cinders.

If wet coal is received, dump in small piles around the edges, where air can get to it freely to carry away moisture, and where other coal will not be packed on top of it.

Mainly Constructional

East and West—From Coast to Coast

A by-law to raise $300,000 for electrical and $277,000 for waterworks improvements at Sherbrooks, Que., was carried recently by the ratepayers.

The Canadian Mead-Morrison Company, manufacturers of steam, electric and gasoline hoists, dredging machinery, conveyors, grab buckets, etc., are taking steps to extend their plant at Welland, Ont.

Building figures for the first three months of the present year, issued by the Building Department of the York Township Council, Ont., total $662,150, an increase of $264,$50 over this period in 1919.

Regina's total in value of building permits issued for the first three months of the present year is $510,200, practically half of which, or to be exact, $260,550, is credited to the month of March alone.

At a recent banquet of the B. C. Technical Association a large turnout of the members celebrated the passing of the bill incorporating professional engineers of the province of British Columbia, by the Legislative Assembly.

It was announced recently by Mr. W. O. Begg, of the Saskatchewan Public Works Department, that a model town planning by-law is being prepared by the department, which, when completed, will be printed in pamphlet form and copies distributed to the various cities throughout the province.

The Board of Water Engineers who will look after the completing of the city aqueduct, at Montreal, will, it is stated, be composed of A. E. Doucet, director of public works, chairman; W. J. Francis, vice-president of the Engineering Institute of Canada, and R. S. Lea, one of the engineers engaged in the drawing up of the plans.

Permits issued during the month of March at London, Ont., totalled in value $99,360, bringing the total for the first three months of the year to $172,520. These figures show large increases over the totals for these respective periods last year, which were $58,520 for the month of March, and $117,845 for the year, to the end of March.

Many large projects are planned for Sydney, N.S., the construction of which is to be commenced this year. The chief among these is a steel plant which will cost, when completed, $50,000,000. Other large undertakings on the program for this year are: Drydock, $3,500,000; ocean terminals, $1,000,000; hotel, $800,000, and several banks, churches and civic improvements.

The Housing Commission of Windsor, Ont., at a recent meeting, authorized the purchase of sites for 50 houses of the bungalow type, construction of which will be commenced at the earliest possible date, as Windsor's housing problem is a very serious one. The Commission has still to its credit over $500,000 of the money borrowed from the Government last year.

A deputation from Hamilton, Wentworth and Lincoln counties, Ont., who waited upon the Minister of Highways, Hon. F. C. Biggs, recently, for the purpose of urging an early start on the construction of the Hamilton-Queenston highway, were informed that work would be commenced on a portion of this highway this year. Mr. Biggs assured the deputation that he appreciated what an important link in the Province's highway system this road is and promised its development as fast as men, money and materials became available.

The Board of Trade's efforts to establish a modern hotel at Sydney, N. S., are showing results. The Dominion Steel Corporation has become interested in this project and a company, composed chiefly of the directorate of the Steel Company, will be incorporated to carry out the proposition. The estimated cost of the new hotel is $800,000. The C. P. R. Hotel Corporation has placed its engineering staff at the disposal of the new company gratis and plans will be in hand shortly. As there is urgent need for this structure, construction will be started as soon as plans are ready.

Personal

Mr. W. F. Welfley, secretary of the Winnipeg Housing Commission, has resigned that position.

Mr. Antonisen, who has succeeded Mr. L. M. Jones as city engineer of Port Arthur, Ont., has entered upon his new duties.

Mr. Walter A. S. Melanson, Moncton, N.B., has been appointed to succeed Mr. Joseph Theriault as dstrict road engineer for the North Shore counties.

Mr. J. B. Fraser, the recently appointed chairman of the Ottawa Improvement Commission, has returned to Ottawa after a lengthy visit to Los Angeles.

T. D. Mylrea has resigned as designing engineer of the Trussed Concrete Steel Company of Canada, Toronto, to take charge of the Toronto office of F. G. Engholm & Partners.

Mr. George Day, late sales manager of M. Beatty & Sons, Ltd., Welland, which was absorbed by the Canadian Mead-Morrison Co., has been appointed Industrial Commissioner of Welland, Ont.

Mr. E. R. Gray, city engineer of Hamilton, along with Controller O'Heir and Ald. Newlands, visited Chicago recently for the purpose of inspecting a new type of vacuum road sweeper in use there.

Mr. Eden Smith, architect of Toronto, has taken into partnership Mr. A. S. Mathers, formerly of 307 Manning Chambers, Toronto. Business will be carried on at 33 Scott St., under the firm name of Eden Smith & Mathers.

Mr. Mark Workman has been appointed chairman of the Board of Directors of the Dominion Steel Corporation, of Montreal. Mr. Roy M. Wolvin will succeed Mr. Workman as president of the corporation and subsidiary companies.

Mr. R. O. Wynne-Roberts, consulting engineer, 40 Jarvis St., Toronto, has been engaged by the town council of Port Colborne, Ont., to prepare plans of a waterworks scheme, sewerage and sewage disposal scheme and of street grading.

Mr. W. T. Chestnut was elected chairman of the Housing Board of Fredericton, N. B., at a recent meeting of the Board. The Board has $100,000 available at the present time for house building and good progress is being made towards an early start on actual construction.

Stanley T. J. Fryer, and William G. Evans, architects, of Hamilton, whose office has been closed while they were in France on active service, have now resumed practice, reopening their offices in the Home Bank building, 72 James street north.

Mr. James A. Irvine, Divisional Engineer on the Bruce Division of the C. P. R., in Ontario, has been promoted to the position of engineer of the London Division, succeeding J. R. Caswell who has been transferred to Sudbury to take charge of the construction work in that division.

Mr. Onisphore H. Cote, of Montreal, has been appointed Trade Commissioner of Quebec City, by the Board of Trade. Mr. Cote was, previous to his appointment, connected with the Shawinigan Water & Power Company. He has been a member of the Engineering Institute of Canada since 1899.

Mr. N. B. Wilson, of Guelph, Ont., has been selected for the position of town foreman of Hespeler, Ont., by the Board of Works of that town. Mr. Wilson is a civil engineer and a returned man and since coming back to Canada has been engaged as instructor at the Department of Soldiers' Civil Re-Establishment, Guelph.

Capt. J. W. B. Blackman has been appointed city engineer of North Vancouver, succeeding Mr. A. M. West, who resigned recently. Mr. Blackman was city engineer of New Westminster for the years 1909 to 1917, when he enlisted and went overseas, returning last year and taking a position as road engineer and superintendent for the municipality of Chilliwack, B.C. The council at Chilliwack has decided to retain Mr. Blackman in the capacity of road superintendent until their present program is completed. Mr. Blackman is to pay frequent visits to Chilliwack to keep in touch with the road work, which will be under the direction of an inspector, to be appointed.

Obituary

Mr. William Woodley, building contractor of Toronto, died recently at his home, 215 Rusholme Rd., at the age of 72 years.

Mr. John W. Mogan, well known painter and decorator of Toronto, Ont., died recently at St. Michael's hospital, Toronto, at the age of 59 years.

Trade Incorporations

S. S. Forbes, Limited, with head office at city of Hamilton, capital $40,000, to carry on the business of general contractors.

National Pavements of Canada, Limited, with head office at Toronto, capital $5,000,000 to carry on the business of paving contractors.

Independent Steel Specialties Corporation, Limited, with head office at Montreal, capital $250,000, to manufacture steel and iron goods.

St. Gregory Construction Co. Limited, with head office at Larochelle, Que., capital $10,000, to carry on the business of road, bridge and wharf contractors.

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks, Sewerage and Roadways

British Columbia, Province of
Tenders will be called shortly for paving on Pacific Highway to cost about $60,000 for Provincial Dept. Public Works. Minister, Hon. T. H. King, Victoria, B. C.

Hamilton, Ont.
City contemplates construction of sewers to cost $5,000, $10,000 and $25,000. Clerk, S. H. Kent.

Hensall, Ont.
Henry Strang, clerk, R. R. No. 1, Hensall, will receive tenders until April 28th for improvements to drain for Osborne Township Council. Plans with clerk and John Roger, Mitchell, Ont.

Lasalle, Que.
Specifications are being prepared in line with appropriation voted by Town for construction of 4.9 miles of bituminous macadam on Lasalle Rd.; 0.94 miles of waterbound macadam on Lafleur Ave.; and 1.6 miles of cement concrete on St. Patrick St. Tenders will be called in before April 30th. Paul A. Beique, civil engineer, will supervise work.

L'Original, Ont.
Tenders will be called April 19th for construction of roads for Counties of Prescott and Russell. Clerk, A. A. Senecal, L'Original.

Metcalfe, Ont.
Frank Iveson, clerk for Osgoode Township, Metcalfe, Ont., has plans and will receive tenders until 3 p.m., May 8th, for drainage work.

Montreal, Que.
Commissioners will call tenders soon for asphalt paving to cost $70,000 for City. Clerk, Rene Bauset.

Administrative Commission will receive tenders until April 19th for sewers for City. Plans at Sewer Dept.

Niagara Falls, Ont.
City contemplates the expenditure of $91,996.37 on paving work for various streets. Clerk, Chas. Black.

Oshawa, Ont.
Walter G. Worden, engineer, will receive tenders until 5 p.m. April 29th for construction of 112,000 sq. ft. of concrete sidewalks for Town.

Ottawa, Ont.
City contemplates the construction of tarvia pavement. Mayor, Harold Fisher.

Suburban Road Commission will receive proposals on the following road machinery: 12 ton steam roller, 450 gallon water waggon, oil distributor with two graders, stone crushers, steam drills, steam tractor for crushers. Secy., Allan Hay, Gloucester St.

Peace River, Alta.
By-law authorizing expenditure of $10,000 on local improvements for Town will be submitted. Address Mayor.

Plantagenet, Ont.
F. A. Senecal, County Road Supt., will receive tenders until noon, April 19th, for construction of 3½ miles macadam road for Russell County Council. Plans with Mr. Y. E. A. Belanger, C.E., Hawkesbury, Ont.

St. Lambert, Que.
Town contemplates the construction of sidewalks to cost $58,000. Secy.-treas., J. R. Beatly.

Stellarton, N. S.
Town has under consideration the expenditure of $15,000 on construction of extension to watermains and sewers. Clerk, J. W. Henderson.

Pictou County Electric Co. plan the construction of permanent road for their track through section of Town. Cost, $25,000.

Stratford, Ont.
A. B. Manson, engineer, City Hall, will receive tenders for sewer, 1½ miles long.

Walkerton, Ont.
Bruce County Council contemplates expenditure of $300,000 to $400,000 on construction of permanent roads this year. Clerk, P. A. Malcomson, Walkerton.

Windsor, N.S.
Town has under consideration the construction of water system to cost $150,000. Engineers, R. S. & W. S. Lea, 10 Cathcart St., Montreal, Que., have submitted their report on additional water supply.

Woodstock, Ont.
City contemplates erection of sub-station. Watermain from reservoir to Mill St., 1,000 ft. of pipe, to be constructed. Supt. Water & Light Commission, J. C. Archibald.

CONTRACTS AWARDED

Alexandria, Ont.
Messrs. K. A. McDonald, N. A. McDonald & A. D. McDonald, Dalhousie Station, Quebec, have general contract for bituminous macadam pavement costing $36,000 for Municipality.

Exeter, Ont.
Concrete pavements costing $35,000 for Town: General contract, R. Hollingsworth, 607 Bank of Hamilton Bldg., Hamilton; sand and gravel, Paris Gravel & Sand Co., R. R. No. 2, Paris Ont.

Guelph, Ont.
City placed contracts for sewer pipe, as follows: Vitrified clay pipe, Clay Products Agency Ltd., 8 Colborne St., Toronto; concrete pipe, Independent Pipe Co., Harbour Commission Bldg, Toronto.

Montreal, Que.
Atlas Construction Co., 37 Belmont St., have general contract for widening of sub-way to cost $50,000 for City.

Port Carling, Ont.
Alf. Hunter has the general contract for cement sidewalks for Village.

Stellarton, N. S.
Contract for paving and sidewalks costing $100,000 for Town has been let to Edwin S. Fraser, New Glasgow, N. S.

Toronto, Ont.
W. E. Taylor, 22 Falcon Rd., Toronto, has general contract for waterworks for York Township.

Railroads, Bridges and Wharves

British Columbia, Province of
Dominion Dept. Public Works plans to expend $400,000 on dredging work in this province.

Louiseville, Que.
L. Denis Caron, sec.-treas., will receive tenders until April 26th for repairs to bridge and piers for Provincial Dept. Public Works.

Moose Jaw, Sask.
W. H. Mathers, Gen. Supt. for C. P. Rly., Moose Jaw, will receive tenders until April 30th for erection of station.

New Ireland, Que.
Thomas R. Porter, secy.-treas., will receive tenders until April 20th for construction of bridge for Municipality.

Prince Rupert, B. C.
E. A. Woods, clerk, will receive tenders until April 19th for construction of timber bridge for City. Plans with engineer, F. S. Clements.

Rondeau, Ont.
Dominion Dept. Public Works will call tenders for repairs to piers costing $17,000.

Sombra, Ont.
A. Selman, commissioner, R. R. No. 3, Sombra, Ont., will receive tenders until April 17th for steel and concrete bridge for Township of Chatham.

Walkerton, Ont.
Bruce County plans to expend $60,000 to $70,000 on construction of bridges. Clerk, P. A. Malcolmson, Walkerton.

CONTRACTS AWARDED

Brisco, B. C.
James Henderson, Golden, B.C., has the general contract for highway bridge costing $7,860 for Provincial Dept. Public Works.

Scott's Junction, Que.
J. T. & J. F. Davis, 308 Drummond St., Montreal, have the grading, concrete and masonry work for extension to railway costing $320,000 for Quebec Central Railway.

Shenacadie, N. S.
E. M. Dixon, Lewisburg, N.S., has general contract for wharf for Dominion Dept. Public Works.

Sober Island, N. S.
Melvin Naugle, West Lawrencetown, N.S., has the general contract for extension to wharf for Dominion Dept. Public Works.

ESTABLISHED 1886

Contract Record and Engineering Review

A National Journal for the Construction Interests of Canada, reaching Architects, Engineers, Contractors, Municipal Officials, etc.

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Contemplated Zone Postal Rates Will Stifle Canada's Growth

It has come to our attention that the Postal Department of the Dominion Government is contemplating an increase in postal rates on Canadian business and technical newspapers. The new rate is zonal, i.e., it varies with the distance from the point of publication, and so great is the increase suggested that it would place a prohibitory tax on anything beyond purely local distribution, thus, in effect, dividing the Dominion into sections between which there would be no means of circulating news and information. This would affect us, as Canadians, in many ways. For example, it would, of course, make it quite impossible for Canadian publications of a national character to exist, and would result in the circulation of foreign publications in Canada, with a consequent increase in the sale of foreign goods, and a corresponding decrease in the demand for "Made in Canada" products.

Another evident example is the influence such a move would have on our immigrant population. Difficult as it now is to assimilate it, this difficulty would be many times greater in the absence of national literature. All our past hopes and ideals of a Canadian "nation" would go for nought. We would become merely an aggregation of groups.

For the Canadian publisher himself, it can be said that he has received little encouragement and no protection in the past. All his raw materials are subject to heavy duty, in spite of which he has been forced to compete with foreign publications entering Canada duty free. In spite of this handicap our publishing houses are to-day covering the country from coast to coast, supporting our industries, urging the conservation of our national resources and the building up of an export trade—in a word. seeking to co-ordinate the various elements in this rich and rapidly developing country, so that we may become an appreciable factor in world history. Is it fair, or wise, to destroy this influence for good which has been built up at so great expense of capital and human energy?

The Daily Press and Its Relation to the Construction Industry

It is quite gratifying to note that the daily newspapers are devoting greater space of late to building activities. In many cases, a weekly or bi-weekly section of a page or more has been developed and in this portion of the paper editorial matter on building activities is combined with advertisements relative to the industry. Such a section under some suitable caption as, "Builders' and Contractors' Section," "Of Interest to Contractors," "The Home Builder's Page," etc.; is, we believe, a splendid idea which it will be worth every contractor's while to assist and promote.

The public know all too little about the building business and are very frequently inclined, in their ignorance, to belittle the industry and misjudge its members. This is because publicity has not been given to contracting activities as much as it should. Lack of organization is probably responsible for this condition, but we are happy to say that contracting is assuming a better footing in this regard, as is in keeping with an industry that ranks in importance next to agriculture only. Organization on a proper basis,—the A. C. B. C. I. for example—will help to give contractors the standing in the community that they deserve, but publicity is as necessary an agent in educating the public to their importance and strength. A builders' page once a week in every newspaper is a splendid means of giving this publicity, for it attracts the attention of just the people that must be enlightened. Such a page provides an opportunity of describing the great pieces of contracting work in which the general public should be more deeply interested and in it can be discussed the problems that builders and contractors have to meet and solve, the methods on which they work and the relation which they exercise toward the public in general.

Contractors will do well to encourage a section of this kind in our daily papers. Other industries have their pages from time to time, why not contracting? The industry will, by that means, benefit by the publicity that is given to its activities and by the greater appreciation that the public will then show in contractors and their business.

Shall We Divide Canada?

IN 1867 our fathers consummated at great price a union of all the provinces and interests of Canada. For over half a century the provinces of Canada have developed together, each the complement of the other.

Canada must be bound together as it is to-day, not so much by the machinery of government as by ideas held in common by all and freely exchanged, so that all sections sympathize with each other. This result has been accomplished primarily by the press, particularly the weekly and monthly periodicals and business papers.

They have no local or sectional bias. They go to all parts of the Dominion. They serve all parts alike. Their service is in bringing all provinces close together into one great nation through one common understanding.

Canada must not be split into a half dozen sections—weak with the evils of sectionalism, disastrous in the extreme—overflowing with narrow provincialism.

Emanating from we know not whither, comes an idea that will rip asunder all the good done in over half a century of patient building.

It is proposed to tax the very thing that has bound Canada into one—to place on the nation-binding press a zone postal tax which would increase the postal charge upon national periodicals as high as 800 per cent. It means loss to you personally and a loss to your country. It will weaken, cripple and in some cases destroy Canadian national periodicals. You will be deprived of papers that have kept you informed on your country's problems, your business problems—that have helped you in your work. And such magazines as do survive will cost you much more.

The publishers are not trying to evade fair taxation. They will gladly accept any fair tax upon their profits.

But is it fair that you should be taxed out of getting journals, papers and magazines that have helped you build your business and in turn built the business of the country?

If you believe in national ideals and national periodicals, sign attached form.

Tear off and mail to-day

CONTRACT RECORD,
347 Adelaide Street West, Toronto, Ont.

I am opposed to any zone postal law which would mean charging higher subscription rates to subscribers, according to distance from office of publication.

Name ....

Address ....

Action Being Taken Against Building Combines in Britain

IN Great Britain, as in Canada, there is a very acute shortage of houses. The Government there has brought in legislation with a view to assisting the people to build, but the result has not been very satisfactory. Every conceivable type of house has been advocated, and owing to the scarcity of brick, concrete has come largely into favor. The reason for the comparative small amount of building—we refer particularly to houses—is the enormous increase in cost, and in this connection there has been an agitation against the so-called "rings" of manufacturers of building supplies. It is strenuously contended that the associations, by means of interlocking directorates and officials, are able to advance prices at will, and are also able to hold up consumers, making them pay prices which are out of all proportion to the cost of the various commodities, thus restricting constructional activities.

The associations, it is claimed, work together, and the members enter into ironclad agreements, as to rebates, etc., which make competition practically impossible. Any builders' supply firm found to violate the agreement is cut off from supplies, and is thus forced out of business.

Prior to the war, European supplies made competition more acute, but the closing of these resources of supplies has enabled the British manufacturers, it is asserted, to advance quotations without check, and certainly some of the rises in prices are startling.

The result of the agitation is a Government inquiry into the so-called rings and the rise in prices. Witnesses will be heard in private, owing to the allegation that traders who give evidence antagonistic to the rings are liable to find themselves unable to get supplies.

Council of E. I. C. Considering Fees for Engineering Service

THE council of the Engineering Institute of Canada, at a meeting held in Montreal, on April 13th, had under consideration the question of raising the fees for engineering work, and also of altering conditions which will make for the betterment of the profession. Mr. R. A. Ross presided, and among those present were Brig. Gen. C. H. Mitchell, Toronto; A. C. D. Blanchard, Niagara Falls, Ont.; H. D. R. Craig, Windsor, Ont.; J. B. Challies, Ottawa; R. O. Wynne-Roberts, Toronto; A. H. Harkness, Toronto; Prof. Peter Gillespie, Toronto; A. B. Lambe, Ottawa; E. R. Gray, Hamilton, Ont.; Brig. Gen. Sir Alexander Bertram; Frederick B. Brown, Prof. E. Brown, Arthur Surveyor, H. H. Vaughan, Montreal; A. R. Decary, Quebec; and F. S. Keith, secretary.

The conference lasted all day, the discussion centering on questions connected with the economic welfare of the members of the engineering profession and ways and means whereby the individual members of the profession might be assisted both in their material and professional capacities. Certain recommendations were made, and a committee appointed to study these, it being agreed that the recommendations could not be adopted without mature consideration.

During the meeting attention was drawn to the fact that an American engineering association had been formed, somewhat along union lines, which had been trying to establish branches in Canada. The consensus of opinion of the meeting was that this was not necessary, and that the Engineering Institute of Canada was doing, and would continue to do, everything possible by way of furthering the interests of the profession in the Dominion. In all probability the result of the conference will be an alteration of tariffs for engineers, which will scale up to the increased costs of modern conditions.

Court Ruling Makes Contractor Responsible for Defects

SOME interesting questions concerning a contractor's liability for the efficiency and durability of construction work he has executed were raised in the Quebec Superior Court in a case decided recently by Mr. Justice Howard, whose judgment was based mainly on the general principle of the law contained in Article 1688 of the Civil Code, to the effect that if a building perish in whole or in part within ten years owing to a defect in construction, the builder is liable for the loss.

Henri Archambault was the plaintiff in the action. He sued Gratton Fils, Limitee, for $292.13, which was admitted by the defendants to be the fair value of material supplied and work performed by plaintiff in repairing the roofs of six houses at Montreal East.

Defendants contracted with Montreal East Construction Company in July, 1917, for the construction of a number of houses at Montreal East. Gratton Fils awarded a sub-contract to plaintiff for the plumbing work and the paper and gravel roofing.

According to the proof, plaintiff did the work in the way he was called upon to do it, and it was duly accepted as being satisfactory to defendants as well as to the general contractors. On February 26, 1918, during a storm in which the wind blew at times at a velocity of sixty miles an hour, the roofs were torn off four houses and on two other houses the roofs were damaged. Plaintiff was then called upon by the defendants to repair the damage. He pretended that defendants verbally undertook to pay him for the work. His action therefore was directed to recover from them the cost of this work.

Principal Points of Defence

Defendants denied the verbal agreement alleged, and in contesting the plaintiff's claim submitted two pleas. First, that defendants acted in the matter, not as principals, but as agents for the Montreal East Construction Company, and if this repair work was to be treated as a separate transaction without reference to the original contract, plaintiff must lose, as his claim was made against the wrong party. In the second place, the defendants pointed to the original contract and said under this agreement plaintiff was bound to make all repairs at his own expense, since he was the builder of the roof and was responsible for his work as such.

"But," urged the plaintiff in reply, "the work was accepted and paid for in full, and that discharged my liability."

Mr. Justice Howard held that the work sued for could not be considered as a transaction separate from the original contract; and as regards the acceptance

No. 20

Canada's Engineers—K. H. Smith

Canada's water powers are among the greatest of her heritages. Generally speaking, we have not been slow to recognize the tremendous possibilities in their consistent development, realizing the benefits that must accrue to the people at large if we stand ready to supply the future demands and requirements of the country. In ensuring the proper development of these resources, waterpower engineers have a vast responsibility and Canada is particularly fortunate in having a body of such engineers who are always alive to the potentialities of proper water power promotion. It will be the privilege of the Contract Record to present in this series from time to time some of the engineers who have done much to harness the great water falls of this country for the benefit of its citizens. For this week, we have chosen one of the youngest, but most enthusiastic water power engineers, in the person of K. H. Smith, the chief engineer of the Nova Scotia Power Commission.

Mr. Smith was born near Tilbury, Kent County, Ontario, in 1887, and received his preliminary education at Chatham Collegiate Institute, Academy at Frewsburg, N.Y., and Essex High School. At the University of Toronto he graduated in both Arts and Engineering, receiving his B.A. degree from Victoria College in 1908 and the B.A.Sc. degree from the Faculty of Applied Science in 1911. Up to the time of his graduation in engineering, he was actively associated with his father in the lumbering and building supply business. In the summer of 1910 he was with geological survey on Vancouver Island, and from 1911 to 1914 with the Dominion Water Power Branch of the Department of the Interior, Canada, on stream measurement, water and power surveys and investigations in British Columbia and Alberta, including extensive surveys of Bow River and professional responsibility in connection with the construction of Lake Louise power plant, Minnewanka storage dam and Kananaskis Falls development. During 1914 he was in charge of the preparation and erection of the Dominion water power exhibit for the Panama Pacific Exposition at San Francisco. This included a personal examination of all the larger power developments in Canada and preparation of models of these. Models of existing and proposed developments on the Winnipeg River were prepared at the same time as part of a complete water power exhibit in the Winnipeg Industrial Bureau.

Mr. Smith later went to Halifax in charge of stream measurements, power surveys and investigations in the Maritime Provinces for the Dominion Water Power Branch, in co-operation with local authorities. In this connection he is the author of several extensive reports for the Nova Scotia Water Power Commission. He is now acting as district engineer of the Dominion Water Power Branch, for the Maritime Provinces; chief engineer and secretary, Nova Scotia Power Commission; chief engineer, New Brunswick Water Power Commission, which Commissions have a considerable amount of hydro-electric development under construction and in contemplation.

Mr. K. H. Smith

Mr. Smith takes an active interest in community affairs generally, being member of the Halifax Rotary and Commercial Clubs. He is a member of the E.I.C. and was largely instrumental in having a branch of the Engineering Institute of Canada established in Halifax, being for some time secretary-treasurer of this branch.

of the work by defendants before the wind blew the roofs off, the Court pointed out that this did not relieve the plaintiff of his responsibility. He was bound by the provisions of articles 1688 and 1696 of the Civil Code.

On the question whether the damage to the roofs having been done by a storm of unusual severity, this could be considered a fortuitous event or a case of force majeure, the Judge said that while it had been proved that the wind was exceptionally strong during the storm in question, it was not unprecedented, and wind of a like velocity might be expected to occur again. In the circumstances, he was forced to the conclusion that these roofs had not been properly constructed.

"Against this," added Justice Howard, "it was said that while all this might be true, defendants were still responsible because plaintiff built the roofs according to their plans and specifications and under their instructions, and, if the roof was not able to withstand the wind, it was their fault. I do not think the proof supports this statement, though the Court is left pretty much in the dark as to how the roof was actually to be laid on. But the fact remains that the roof of the other houses withstood the storm while it was torn off these four houses and damaged on two other houses, all of them having been constructed by the plaintiff. If the plaintiff is to be considered as a builder and not merely as a laborer working by the day, he must be held responsible for his work."

Judgment was accordingly given dismissing plaintiff's action with costs.

Groynes of Concrete Posts and Planks to Protect Lake Nipissing Shore

Destructive Erosion at North Bay, Ont., to be Prevented by Series of Groynes Every Five Hundred Feet Along Shore

By A. Langlois, B.A.Sc., C.E.

THE town of North Bay, Ont., is situated on the north-east shore of Lake Nipissing, extending along it for a distance of about three miles. In recent years a considerable amount of erosion of the shore has taken place, resulting in the destruction of valuable property. If nothing is done to stop this scouring, it will certainly continue to do serious damage to the shore and property. Surveys and study of the situation were made by the Department of Public Works in 1917, and plans were devised as to means of increasing the resistive power of the bank against the waves and prevent further erosion of the beach.

Figs. 3, 4 and 5 show some of the damage done to the bank in late years, and Fig. 2 shows the bank opposite the Canadian Pacific property. At this point the railway company, some years ago, covered the bank and the beach to the water's edge with a layer of course stone and gravel extending over the whole of their property. That part of the shore is holding pretty well, but the small amount of erosion done to the beach is not, however, entirely due the stone protection of the bank. The long government wharf situated west of the C. P. R. property is responsible, to a great extent, for the good state of the shore there, by offering a strong barrier to the movement of the waves coming from the direction of the prevalent winds.

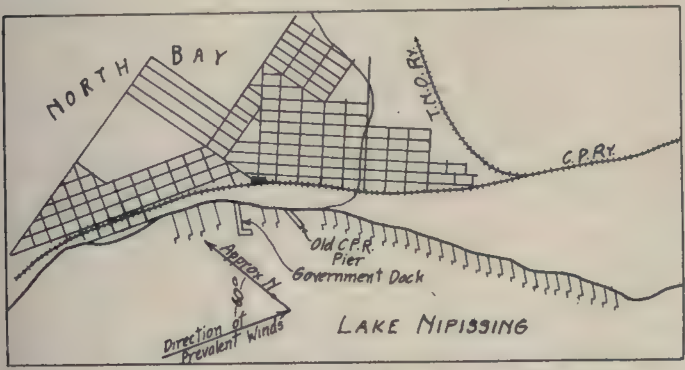


Fig. 1—Groynes are to be built along shore of Lake Nipissing to prevent erosion

Walls and Bulkheads Useless

The condition of the bank all along the shore in question proves fully the uselessness of walls or bulkheads. One particular case is where a concrete wall, some hundred feet long by about six feet high above the level of the foot of the bank, was built to protect a house. This wall did not last long against the along-shore movement of the waves, and I noticed more damage to the bank there than anywhere else, the wall having collapsed and having completely sunk into the ground carrying with it 60 ft. of the bank and part of the house which was solidly built on concrete foundation. Generally all the walls or bulkheads built by private owners on this shore have been of no use for the purpose for which they were erected, except, perhaps, to postpone for a short time further destruction of the bank.

The ground is of sand to a considerable depth and I myself experienced a displacement of the sand on the beach of between two to three feet deep, in one night, and this for the entire length of the shore, except in front of the C. P. R. property and on the east side of the Government wharf.

The direction of the prevalent winds is at a small angle with the shore. It is almost parallel to it at some points. What is proposed to be done for the present is the building of a series of groynes to first see the effect towards the foot of the bank. There is no doubt that with a good system of groynes, the beach can be built up again to a considerable height above its present level. Of course, a wall of some kind will eventually have to be built at the foot of the bank to prevent its rolling off towards the lake, as the sand of which the banks are formed is quicksand and flows like water through numerous small gullies in the bank when the wind blows seaward. But the dimensions and exact position of such wall cannot, I think, be decided until a year or two after the erection of the proposed groyne system.

Directions to be Given to the Groynes

In the present case the proposed groynes must be placed at right angles to the current or to the direction of the prevalent wind waves, in order to prevent, as far as possible, any concentration of the waves along the groynes, and to prevent any sand accumulation at one place, as the alongshore currents would be diverted in seaward or landward course. Here there are no littoral currents, and we know that the waves strike the shore in an oblique di-

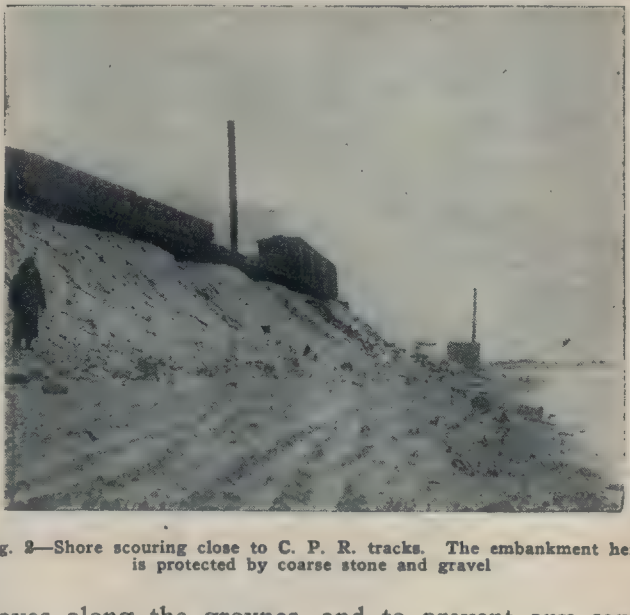
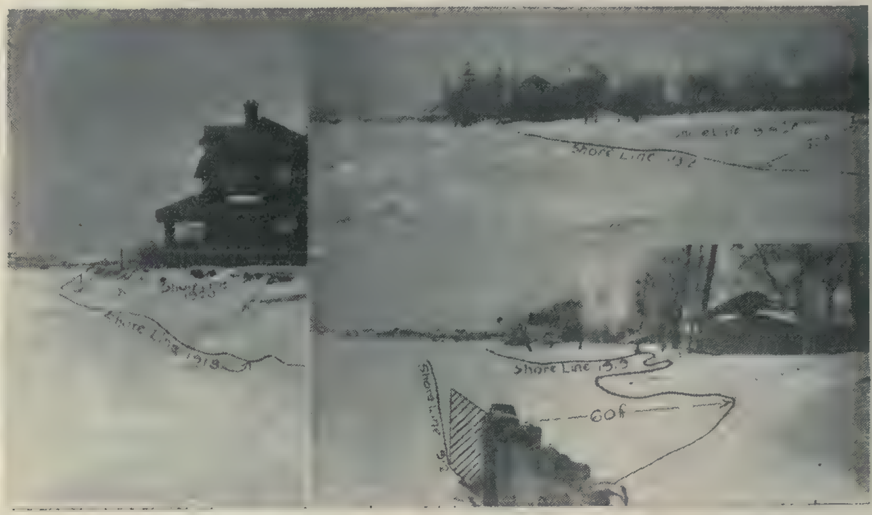


Fig. 2—Shore scouring close to C. P. R. tracks. The embankment here is protected by coarse stone and gravel



Figs. 3, 4 and 5—These illustrations show the extent of the shore erosion on Lake Nipissing, to prevent which it is proposed to build a series of groynes.

rection, never normally, consequently, the shore part of the groyne must necessarily be built perpendicular to the direction of the prevalent winds.

An old existing wharf belonging to the Canadian Pacific Railway (see Fig. 1) helps much, I think, to determine the proper angle with the shore at which the groyne must be placed. The effect that it had in preventing the erosion of the beach on both sides of it can easily be seen, and according to experiments of groyne systems, it is laid at about the correct angle with the shore. On one side of the said wharf no erosion has taken place below its top, and on the other side it is seen that what erosion took place was due to the absence of another sand collector.

On account of the absence of littoral currents, the rebound will undoubtedly cause the waves to flow seaward, carrying the sand away again from the shore. Therefore our groynes will have to be erected so that the outer part will prevent any scouring and intercept the movement of the suspended sand seaward. For this reason they are planned out to follow a curve (see details for length), and the lake end of the groyne will follow the direction of the prevalent wind waves.

The groynes as proposed will extend from the high water mark to some distance seaward of the low water mark. However, the longer the groyne, the greater will be its efficiency. The distance between the groynes must not be greater than the distance between high and low water marks, but it may be less if that distance is too great. They must not be placed too close together, however, as they might cause the formation of eddies or swirls from one groyne to another. The spacing of the groynes is an important point I think. The results obtained may be worse if the interval between them is too great, than if it is too short.

The groynes will be built so that they can be raised as the beach fills up. Two feet above the shore surface is considered enough to begin.

Methods of Construction

The groynes will be built so that they can be added to in height from time to time as accumulation takes place. They will consist of concrete posts with planking between them. This way of building the system has been considered the cheapest and the best. Stone and brush systems have often been tried before,

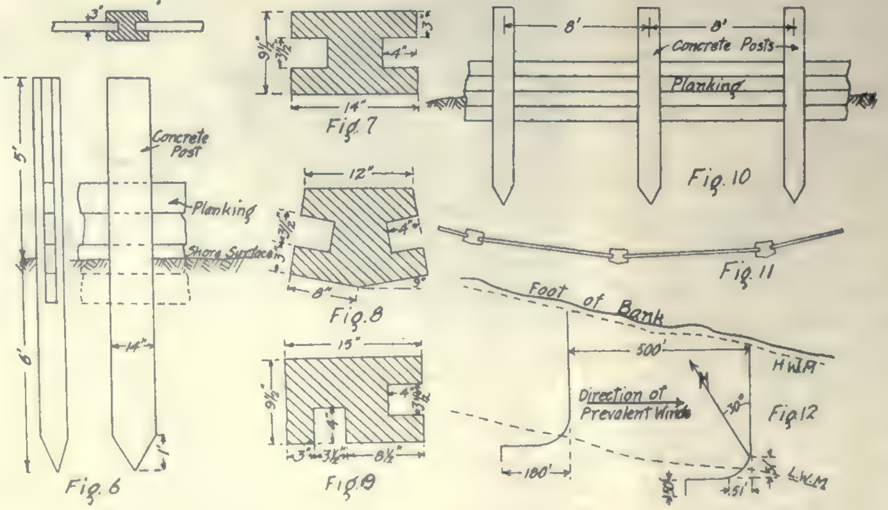


Fig. 6—Elevation of groynes posts; Figs. 7, 8, and 9, Sections of posts on a straight line, on curves and at corners, respectively: Fig. 10, elevation of groyne; Fig. 11, groyne along curve; Fig. 12, general arrangement of groynes.

but with very unsatisfactory results, besides being more expensive than the pile and plank system. The concrete posts will be 14 in. by 9½ in. and 11 ft. in length, 6 ft. driven into the ground and 5 ft. above the surface of the beach. They will be spaced c. to c. for their entire length. Three inch lumber will be used for the planking. No difficulties are expected in the erection of the proposed system.

The question of damage by the ice was fully considered, but no trouble is expected in that connection, as the beach should be filled to the top of the planking at the time of the freezing of the lake and the expansion of the ice upwards will have no effect, as at that moment the posts will be about 8 ft. into the ground, in a position to hold their own pretty well.

One of the most important points in connection with this system, is the profile to give to the groynes. A cross section of the beach should be taken immediately after a storm and the groynes built following the new surface line of the bottom.

Past Season's Road Work in Nova Scotia

Greater Use of Road Machinery Increased Efficiency of Operations—The Labor Shortage Retarded Work

By J. W. Roland*

DURING the season of 1919, great improvement was made in our highways throughout the entire Province. Ordinary maintenance work carried on out of revenue has in most cases been performed with more care and efficiency than ever before, and has produced correspondingly better results.

Notwithstanding a very general and widespread belief to the contrary, a much larger sum was expended out of revenue upon secondary than upon primary roads in practically every county in the province.

The good results obtained in the maintenance work is due in large measure to the employment of the best available foremen to have control of all work within given districts. And our hope for efficient and economical road maintenance in the future lies in the extension of this policy in such a manner as to keep these foremen continuously employed with small permanent gangs doing work by the patrol method, rather than by the periodic method of making repairs once annually, and neglecting all needed repairs for the balance of the year.

Use of Machinery

Another factor which entered largely into increased maintenance efficiency during the past season was the greater and more intelligent use of road machinery, including the road-drag, grader, tractors, etc. Drags were used fully 100 per cent. more than ever before, and a growing appreciation of their value is to be noted.

Notwithstanding the great difficulty experienced in securing teams to handle them, our standard graders (of which there are about 170 in service) were used more freely than ever before. Wherever tractors could be hired to haul graders they were employed and gave good satisfaction. Most of the available farm tractors appear to be a little too light for this service. Two Baker-Robb tractors, built by the Robb Engineering Works, Amherst, were purchased during the year, and did splendid work, both in hauling graders and running portable stone crushing plants.

The use of the two horse road grader was also greatly extended during the past season. In 1918 a few of these small graders were introduced and their immediate popularity lead to a greater demand for more in the spring of 1919. Accordingly, 45 new graders of this type were purchased to fill the requisitions made by county superintendents.

These machines have a reversible 5-foot blade and weigh only 750 pounds, but they have been found to be stout enough to stand the strain exerted by four horses. Two horses, however, can handle the machine satisfactorily, and do a surprising amount of work in many places where it had formerly been the custom to use the standard grader with six to eight horses.

Truck Equals Four or Five Teams

The experience with graders and tractors during the past year leads us to the conclusion that the greater part of the grading required in our road maintenance work can be carried on best with the two horse grader. Heavier repair work and reconstruction of our graded roads can best be performed using a grader considerably heavier than our present standard, this to be hauled by a kerosene tractor. A comparatively small number of the heavy graders would be required.

The motor trucks purchased last spring were late in arriving, but gave excellent service while in use. In all 24 trucks were purchased—eleven 2 ton trucks and thirteen 1½ ton trucks. These were used principally upon construction work, and where considerable expenditures were being made. It was found advisable to use them in batteries, of from two to four trucks depending chiefly upon the length of haul. One of these trucks was found to be equivalent to four or five two horse teams.

Road Construction

Capital expenditure, whether from county loan—as in Cape Breton and Halifax counties—or from provincial loan—was made entirely upon the main highways. The work done has been of very high standard and the Board has been very generously complimented upon the improvements effected.

Particularly good work has been done in Cape Breton county, in the vicinity of the Sydneys, and in Halifax county, where both county loan and provincial loan monies were spent. Notable work was also done between Whycocomagh and Ross' Ferry in Inverness and Victoria counties; on the Guysborough-Canso Road; and upon the road between Port Joli, Queens county, and Sable River, Shelburne county, notoriously known as "The Devil's Pass." None of these roads were completed, but plans are being made with that end in view.

It has been the aim of the officials of the Department to expend all capital monies upon improvements of a permanent nature, and this has been carried out in the very great majority of cases. The very large number of comparatively small capital expenditures, ranging from $500 to $2,000, made it practically impossible for sufficient supervision to be given to all projects by myself or anyone directly connected with the headquarters' office. Consequently, the results hoped for from these expenditures did not in all cases come up to expectations. It is hoped that capital monies may hereafter be appropriated in amounts sufficiently large to justify proper planning before, and competent supervision during construction.

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*Chief Engineer, Provincial Highways Board of Nova Scotia.

Indeed if competent contractors are to be interested in road building in this province, the number of projects to be undertaken annually must be comparatively limited in number, and I firmly believe that success in overtaking the programme of highway construction planned by the Provincial Highways Board can only be achieved by having the work carried out by contract in comparatively large units.

Labor Shortage Retarded Work

As in the previous year, the labor shortage seriously retarded road work throughout the province during the entire season. In a number of cases only the very poorest class of labor was available at all, and this together with the prevailing high wages, made the cost of work much greater than in former years.

The only solution of the labor problem, in so far as our maintenance work is concerned, seems to lie in the formation of small permanent patrol gangs. This would make us independent of local labor and enable us to make repairs and carry on the ordinary operations of road maintenance at the most advantageous times.

Labor for construction purposes presents a somewhat different problem, and so far as I can see, the solution will only be found when as much of our construction as possible is performed by contractors, in units sufficiently large to make it worth while to operate camps where the workmen can be comfortably sheltered and well-fed.

Laws Respecting Highways

It is desirable to have the various acts relating to the public highways, culverts, bridges, etc., rewritten and consolidated. Great confusion exists in the minds of the public and other parties especially interested, as to their rights and powers under present laws. This confusion could well be removed by writing all laws, referring in any way to the public highways into a single act, and by giving the necessary publicity to such parts of the act as are of more special interest to the public.

Bridges and Culverts

All bridges and culvert work carried on during the year has been under the direction of Mr. J. E. Belliveau, assistant chief engineer, who reports as follows:

There was expended on larger bridge construction out of capital account, during the calendar year 1919, the sum of $58,842.87.

The expenditure on construction of larger bridges since 1883, under the several larger bridge acts, is as follows:

Expenditure to Dec. 31, 1918	$3,614,846.49
Expenditure to calendar year. 1919......	58,842.87
Total expenditure to Dec. 31, 1919	$3,673,689.36

The only work of large magnitude undertaken during the year was the remaining portion of the substructure of the Annapolis-Granville Ferry Bridge. The contract was let to Messrs. Engineers and Contractors, Limited, of St. John, and the work was begun by them in the month of August and prosecuted with vigor until the month of December. As soon as the weather permits in the spring, the work will be resumed and, it is believed, will be brought to satisfactory completion early in the season.

Tenders for the construction of the superstructure were advertised for in December and the contract awarded to the Maritime Bridge Company, Limited, early in the present year. The entire bridge should be ready for traffic before the end of the year.

The balance of the work carried on during the year consisted of the construction mostly of King Post and Queen Post Truss Spans and crib work substructures and, in a few cases, of small concrete bridges ranging in size up to 20 ft. spans.

Payments during the year were made on 96 wooden bridges and 21 permanent ones.

According to the bridge act, all bridges heretofore built, and which if built of permanent materials would cost not less than $500. are subject to the provisions of the Act; but no bridge can be brought under the Act if the total cost—if built of wood—is likely to be more than $150.

It is evident that owing to the increased cost of materials and labor during the past few years, many bridges which it was not intended should be brought under the bridge act are being added to our list of larger bridges each year. These bridges are rebuilt out of provincial capital and the cost of their maintenance is a first charge against the legislative grant for highways.

I believe this situation is one which merits very early attention on the part of the Highways Board, and perhaps an amendment to the clauses paraphrased above should be sought. The entire bridge act should be revised and incorporated as a part of a new act relating to highways.

Culvert Construction

With reference to culverts, Mr. Belliveau reports as follows:

From the first days of the culvert construction to the close of the calendar year 1917, the installation of permanent culverts was done with the aim of renewing all structures on the more important highways. It was, therefore, possible to let contracts of large magnitude. During the year 1918, however, it was strongly felt that the construction of culverts and the improvements of highways should be carried side by side and this plan was followed in the year 1919.

It should be noted here that it was decided to discontinue the building of the pipe culvert and to substitute therefore a "built-in-place" concrete culvert. Although the new type costs slightly more than the old, its increased value is in excess of the difference in costs.

Cheap Power from the St. Lawrence

Speaking on behalf of the Canadian Deep Waterways and Power Association before the recent Buffalo sitting of the International Joint Commission, Secretary Alex. C. Lewis, Toronto, said that Ontario was vitally interested in the power development of the St. Lawrence waterways. His opinion, to be substantiated in detail at an Ontario sitting, was that electrical energy could be produced on the St. Lawrence at less cost than anywhere else on the continent. There would be sufficient revenue from electrical development to pay interest and sinking charges on the work of canalization.

Longest Spans for North American Bridges

FOLLOWING is a list of the longest spans for different classes of bridges in North America, compiled by Mr. Henry S. Jacoby, professor of bridge engineering, Cornell University.

Simple plate girder—130 feet 6½ inches, Grand Crossing Illinois, on the Nickel Plate railroad; completed in 1916.

Steel viaduct, 100 feet, Lethbridge, Alberta, on Canadian Pacific Railway; completed in 1909.

Simple truss, riveted, 643 feet 10½ inches, Louisville, Kentucky, Pennsylvania Lines; completed in 1919.

Simple truss, pin, 720 feet, Metropolis, Illinois, C. B. & Q., and N. C. & St. L. railways; completed in 1917.

Swing plate girder, 236 feet, over Lachine canal near Montreal on Canadian Pacific railway; completed in 1915.

Swing truss, 521 feet, Portland, Oregon, on Northern Pacific railway; completed in 1908.

Vertical lift, 296 feet, N. Mondak, Montana, on Great Northern railway; completed in 1914.

Bascule, single leaf, 260 feet, Chicago, Ill., on St. Charles Air Line railway; completed in 1919.

Bascule, double leaf, 336 ft., Sault Ste. Marie, on Canadian Pacific railway; completed in 1914.

Aerial ferry, 393 feet 9 inches, Duluth, Minnesota, over U. S. Ship canal; completed in 1905.

Continuous truss, 775 feet, Sciotoville, Ohio, on Chesapeake & Ohio and Norfolk & Western railroad in 1917.

Cantilever, 1800 feet, Quebec, Canada, on Canadian National railroad; completed in 1917.

Suspension, 1600 feet, New York City, Williamsburgh bridge; completed in 1904.

Steel arch—3 hinged, 592 feet, Needles, California, highway bridge over Colorado river; completed in 1916.

Steel arch—2-hinged, 977 feet 6 inches, Hell Gate, New York City, on N. Y. Connecting railroad; completed in 1917.

Steel arch, not hinged, 519 feet 9⅜ inches, St. Louis, Missouri, on Pennsylvania Lines; completed in 1874.

Stone arch, 220 feet, Washington, D. C., aqueduct bridge; completed in 1864.

Plain concrete arch, 281 feet, Monroe street, Spokane, Washington; completed in 1911.

Hamilton Builders Form Branch of A.C.B.C.I.

Two Hundred General and Trade Contractors and Supply Men Organize on Scheme Laid Down by National Body

FINAL details of the organization of a Hamilton, Ont., branch of the Association of Canadian Building and Construction Industries were arranged on April 10th at a meeting of contractors and supply men held at the Royal Connaught Hotel. The organization has been completed on the lines of the recommendations of the A.C.B.C.I. which aims at organizing the whole country from coast to coast on the basis of three fields of action; namely: local, provincial and national.

At the meeting the new constitution and by-laws were studied clause by clause and finally adopted.

Officers were elected for the coming year as follows: President, J. M. Pigott; first vice-president, Jas. Mercer; second vice-president, Samuel Howard; hon. treasurer, Fred T. Brooks; hon. secretary, G. Stewart.

A live general secretary will be engaged as soon as possible, and standing committees for the various detail work will be struck.

The president, in speaking after the elections had taken place on Saturday night, made several statements of general interest. After outlining the general purposes of the National and Provincial bodies, he dwelt particularly on the work to be done locally.

Briefly summed up, he stated that building in Hamilton and in Ontario was becoming too expensive. Organized labor with their extortionate demands were running the building industry into a blind end. The arguments of the unions that high wages did not hurt the contractor so long as he was protected by their agreements with him, was fundamentally wrong. The contractors owed something to the community and to the prosperity of the country, and it was their duty to see that the increases demanded from time to time were actually warranted, and to fight against increases beyond that point.

In Hamilton the demands of the two most important trades were for increases of approximately 50 per cent. over last year. It should be the first duty of the association to see that no such increases were granted. Already, because of the extremes to which these prices have gone, many large enterprises that Ontario should have had, are locating in Quebec. Quebec was experiencing a building boom such as they never dreamed of. He believed the unions were directly responsible for this.

He cited the criticism of one very large industry, about to locate here, that contractors were largely responsible for this because of the apathy with which they regard the wild heights to which the cost of building had gone and is still going. It should be the duty of such industries now to co-operate with the men who were making the sacrifices, and to support the association. He pointed out that the association should endeavor to make clear to prospective builders, that by bringing in large outside concerns, sometimes from over the line, they took full advantage of the result of the association's work, but, by such an act dealt the association a blow in return.

The Hamilton association will include some two hundred members made up of general contractors, trade contractors and manufacturers and supply houses identified with the building industry. Already the association includes some of the largest industries of the city.

Concrete Roof Tile and Cement Asbestos Shingles

Methods of Manufacturing and Laying Two Types of Roof Covering that are Fire Resistant

In presenting the following reports to the National Conference on Concrete House Construction at Chicago the Committee on Concrete Roofing Tile and Cement Asbestos Shingles called attention to the great need for a wider use of fire resisting roof coverings. It is estimated. states the report, by the National Board of Fire Underwriters that of the 23,203 dwelling house fires reported in 1917, which caused aggregate losses of more than $66,000,000, that 20 per cent. were caused by the ignition of inflammable roofs. Both concrete roofing tile and cement asbestos shingles are among the most fire resistant types of roofing known, thereby contributing to the safety of property and occupants of dwellings by eliminating the most hazardous fire exposure to which dwelling houses are subjected. The report of the committee goes on to discuss the merits and application of these products.

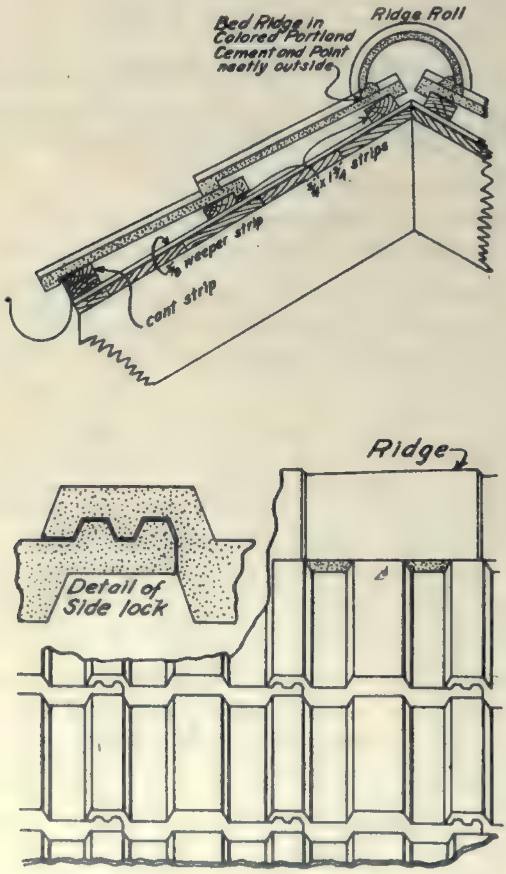


Fig. 1—Above, ridge details; below, typical details of concrete roof tile

Both concrete roofing tile and cement asbestos shingles are moderate in first cost and susceptible of most pleasing architecural development.

The selection of roofing is one of the most important problems confronting the architect in determining the appearance of a dwelling structure, and the wide variety of types and colors readily available in these types of roofing make possible a selection of designs of rugged effect casting bold shadows where advisable. This variety is of a special value where a number of houses are to be built of similar material or general design in the immediate vicinity. Without altering the structural features below the roof-line, the architect can, by the exercise of taste and ingenuity, so vary the design and shades of roofs on adjacent houses that the monotony so noticeable in many large housing developments is largely avoided.

The structural qualifications and peculiar merits of each are set forth in the appended individual reports.

Reports on Concrete Roofing Tile

Concrete roofing tile are composed essentially of portland cement and suitable aggregates. They should meet the requirements of the American Concrete Institute Proposed Standard Specifications for the Manufacture of Concrete Roofing Tile, Standard No. 22, and suggested addenda as embodied herewith under "Specifications."

They are generally produced in standard size of 9-3/16 inches by 14¾ inches, overall dimensions. Their weight is approximately 5½ pounds each. 150 tiles are required per square of 100 feet which weigh, when applied in place, approximately 825 pounds. They are usually furnished with double side lock for efficient exclusion of weather. Owing to their accurate plane surface and freedom from warpage, 3 inch end lap is sufficient for good construction.

They are commonly furnished in standard colors of red, green, brown and natural gray and can be furnished in various other special shades, if desired.

Standard details such as ridges, hip rolls, gable starters and gable finishers and finials are regularly furnished by manufacturers.

Concrete tile roofs are permanent, requiring no maintenance expense, and are practically indestructible. Their freedom of expansion and contraction as provided in joints between each tile eliminates destructive contraction or expansion effects. They are unique in the high salvage afforded, in event of wreckage or alteration of structures on which they are placed. Concrete tile are permanently attractive, their surface being smooth and non-absorptive; they do not discolor.

Concrete roofing tile are economical. They are moderate in first cost. The reduction in insurance premiums, will much more than pay for the interest on the additional investment over less fireproof roofings. Their rich and substantial appearance enhances the sale value of the house on which they are applied, by several times their total cost.

They reduce fuel consumption in winter, the dead air space between sheathing and tile being a most

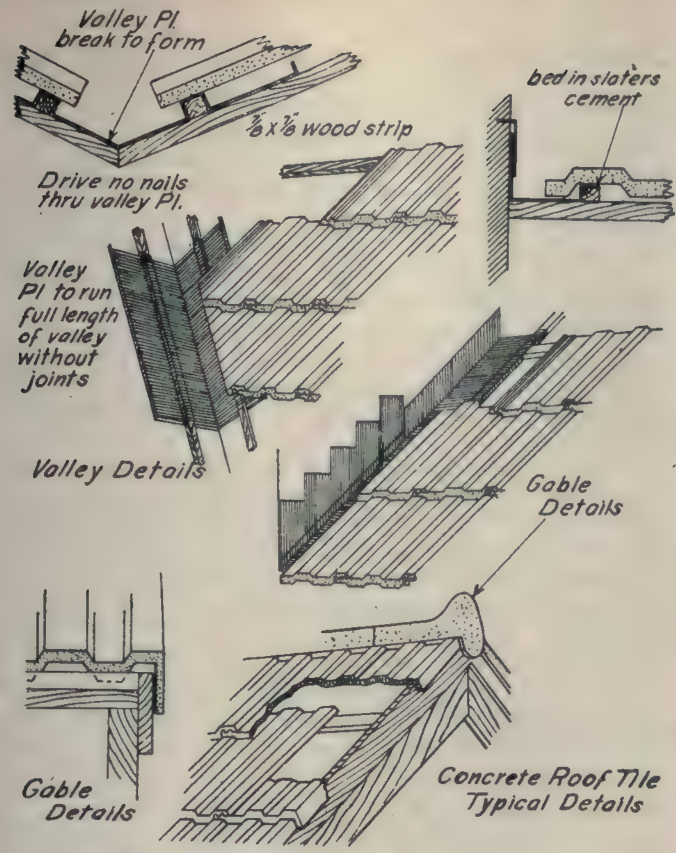

Valley Pl. break to form
⅞x⅞ wood strip
Drive no nails thru valley Pl.
bed in slaters cement
Valley Pl to run full length of valley without joints
Valley Details
Gable Details
Gable Details
Concrete Roof Tile Typical Details

Fig. 2—Gable and valley treatment with concrete tiles

efficient insulator. Conversely, they are correspondingly cool and comfortable in summer.

Their uniform size and true surface render it possible to erect them more rapidly and economically than any other roofing product and has led to their favorable recognition by labor. They have been approved as loan risks by financial interests.

Recommended Practice

Rafters should be not less than 2 by 6 on 20-inch centres. The use of collar or tie beams is recommended. Roof sheathing should be shiplapped, at least 1-inch material, well seasoned and closely laid. Gable facia or barge rafter should be placed with top edge 1⅛ inch above roof sheathing to come flush with top of nailing strip. Flashing and sheet metal work should be in place complete before the worker starts work. Aprons and counterflashing, under which felting extends, should be raised 3 inches for proper laying of felt.

Specifications for Concrete Roofing Tile

Concrete roofing tile shall be furnished and applied in accordance with the specifications of the American Concrete Institute, Standard No. 22, Proposed Standard Specifications for the Manufacture of Concrete Roofing Tile as follows:

(1) These specifications apply to concrete roofing tile approximately 9 by 15 inches over all.

(2) Concrete roofing tile meeting the requirements of these specifications may be used in building construction.

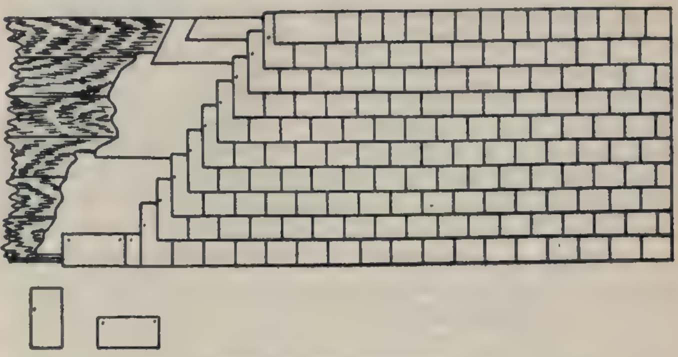
(3) (a) Concrete roofing tile must be subjected to load test. (b) Tests shall be made on full size samples. At least 10 samples must be provided for the purpose of testing and must represent the ordinary commercial product.

(4) The breaking load shall average not less than 150 lb. per tile when the load is applied in accordance with the method described below. Lots of tile intended for building construction may be rejected if more than 10 per cent. of the samples tested break at loads of less than 100 lbs.

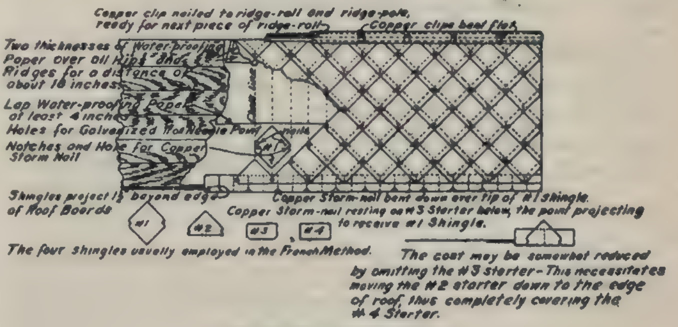
(5) (a) Method of testing: Tile shall be tested with face up. The tile shall be supported under the lugs near the ends if the tile have lugs, and in no event shall the span be less than 13 inches. The support under one end shall be rigid and the support under the other end shall rest on a roller bearing to allow for variation in the under surface of the tile.

(b) The load shall be applied in the centre of the tile by placing a rigid bar having a semi-circular bearing across the tile midway between the points of support. From this cross bar shall be suspended a bucket-like receptacle which shall be loaded with shot, sand or other suitable material until the tile breaks.

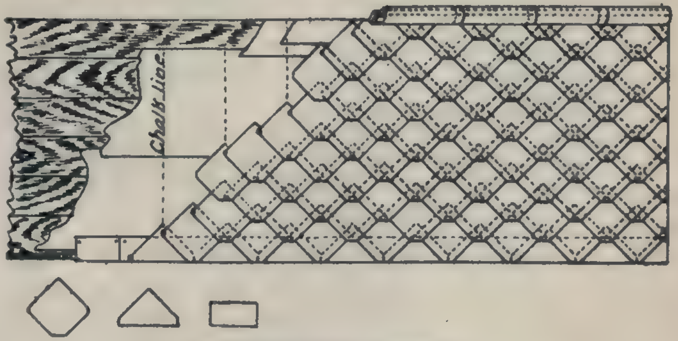
(6) Portland cement shall be used in the manufacture of concrete roofing tile and shall meet the re-



AMERICAN METHOD


Copper clip nailed to ridge-roll and ridge-pole, ready for next piece of ridge-roll
Copper clips bent flat
Two thicknesses of Water-proofing Paper over all Hips and Ridges for a distance of about 18 inches
Lap Water-proofing Paper at least 4 inches
Holes for Galvanized Wall Needle Point nails
Notches and Hole for Copper Storm Nail
#1
Shingles project 1½ beyond edge of Roof Boards
Copper Storm-nail bent down over tip of #1 Shingle.
Copper Storm-nail resting on #3 Starter below, the point projecting to receive #1 Shingle.
#1
#2
#3
#4
The four shingles usually employed in the French Method.
The cost may be somewhat reduced by omitting the #3 starter - This necessitates moving the #2 starter down to the edge of roof, thus completely covering the #4 Starter.

FRENCH METHOD



HONEY COMB EFFECT

Fig. 3—Methods of laying cement asbestos shingles

quirements of the current Standard Specifications for portland cement adopted by the American Society for Testing Materials.

(7) Aggregates used in the manufacture of concrete roofing tile shall be of such a nature as will produce the quality of the tile required by these specifications and the following addenda:

Absorption of concrete roofing tile shall not be more than 6 per cent. in 48 hours. They shall not be warped more than ⅛ inch from plane surface and shall not vary more than 1/16 inch in thickness.

How They Are to be Laid

Concrete roofing tile shall be laid in accordance with the following specifications: Over the sheathing, lay approved 12 lb. tile felt roofing paper, or heavier, parallel to eaves. Felt shall be lapped not less than half the width of the sheet on every course. An extra ply of felt shall be laid next the eaves. Cap all hips longitudinally with extra ply of felt at least 12 inches wide. In valleys, lay one extra ply, full sheet wide, longitudinally. Where felt extends against vertical walls, same shall be carried at least 6 inches on vertical surface under counter flashing.

The roof shall be watertight after applying the felt. The roofer shall install valley plates as furnished, cut and broken to fit, by the sheet metal contractor in accordance with illustration attached hereto.

Over felting lay 3/16 inch strip from eave to ridge. Nailing strips ¾ x 1¾ shall be nailed above lath (see sketch). The roof shall be accurately laid out with rule and chalk line by the roofer and when finished, courses shall present a straight and uniform appearance when viewed vertically, horizontally or diagonally. All hip and ridge roll shall be laid accurately and bedded in 1.3 portland cement mortar (see detail) colored to match balance of roof with approved mineral color. The roofer shall guarantee his work to be watertight and remain so for a period of five years from the date of completion and to replace any defective tile or tiles appearing during this period.

Automatic Machinery for Making Shapes

Your committee recommends that in view of the extensive and rapidly increasing use of concrete roofing tile, that the immediate development of automatic machinery for producing these shapes economically be strongly encouraged. There is immediate necessity for such machinery.

Your committee also finds that the use of steam in curing the tiles after manufacture assists very materially in producing high grade products and the use of this method should be insisted upon by users.

We also recommend that manufacturers be encouraged to investigate the use of light aggregates in view of determining their suitability in developing roofing tiles retaining all of the architectural and structural features embodied in the present product and of minimum weight.

We also note that the establishment of erection and service departments by reputable manufacturers has become well-nigh universal and we recommend that this policy be encouraged.

Reports On Cement Asbestos Shingles

Cement asbestos shingles are composed essentially of portland cement and asbestos fibre, about 75 per cent. of the content being portland cement. They are of Austrian invention, and large amounts of capital and effort have been expended in perfecting their commercial production.

After exceptionally thorough mixing, which is accomplished in machines somewhat resembling a pulp beater commonly used in paper mills, the pulp mixture of cement and asbestos is dropped on a wide moving felt conveyor whence it is conveyed between heavy rollers and to a pressure roll where successive layers are laid upon this roll from the felt. The material is thus built up in piles. When the desired thickness is reached, the sheets, still wet, are cut off and run through a cutter where the shingles are cut from the sheet into uniform sizes. A number of other operations are performed, the shingles being pressed to remove the bulk of the moisture and produce a smooth surface. They are then seasoned, trimmed and drilled.

Cement asbestos shingles are approximately 3/16 in. thick. They average in weight 435 lbs. per square (100 square feet) for the American type and about 275 lbs. per square for the French or diagonal type. They are made in a variety of shades and are commonly furnished in standard colors of grey, red, brown, dark slate and green. They are available in various shapes, commonly furnished in rectangular and diamond shaped shingle forms. The application of these shingles is so simple that any carpenter skilled in applying wooden shingles, or any roofer, can apply them in minimum time, as all nail holes are punched in asbestos shingles during the course of manufacture.

Methods of applying these shingles are illustrated in the accompanying sketches. The first shown is the French or diagonal. The second, the honeycomb, and the third the American or straight-laid method. The diagonal, or honeycomb method is much cheaper, as it does not require as many shingles per square, more of the surface being exposed than in the American method. However, the diagonal methods do not afford nearly the same opportunity for architectural development that the straight-laid methods do.

Long experience has proven the fact that asbestos shingles give very pleasing effects not only to the more expensive residences, but also to workingmen's houses, and group dwellings.

Attitude of West Toward St. Lawrence Canal

The attitude of the Canadian West towards the canalization of the St. Lawrence Canal was expressed by Alex. C. Lewis, secretary of the Canadian Deep Waterways and Power Association, at the Buffalo sitting of the International Joint Commission. Mr. Lewis stated: "The assumption that the benefit of water transportation to the markets of Europe is the inalienable right of the Atlantic seaboard and that the Central and Western sections of these two great countries be forever hampered by the excessive cost of long rail haul cannot any longer be suffered. The West cannot develop in the condition of servant to the East, and the producers of the Centre and the West will no longer tolerate confinement to a limited market with a deep waterway at their very door."

Intention of the Manitoba government to vote a million dollars, and more if it be required, in supplementing the federal grant for the erection of houses in that province, was announced in an amendment carried in the legislature at a recent sitting.

Co-operation Between Engineers and Chemists

Better Results in Plant Design Obtained by Working Hand in Hand—Paper Read Before Toronto Branch E.I.C.

By T. Linsey Crossley*

THE functions of chemist and engineer are not comparative but supplementary. In the industrial applications of chemistry today a problem becomes a matter of engineering as soon as it leaves the laboratory and even before that, its engineering features must be studied. On the other hand many things that appear to be purely matters of engineering depend for their success on due attention to the chemical composition of the materials used. In the conduct of large chemical and metallurgical work, especially, it is most apparent that chemist and engineer must go hand in hand.

In the "Times" Engineering Supplement of July 28, 1916, there is an article by Prof. Donnan, on the Necessity of Co-operation, from which the following is taken:

"The tremendous development of applied chemistry caused by the grim necessities of war has revealed an appealing want of men trained in the right sort of way for this work. There are two main reasons for this. The great majority of British chemists have been trained at the universities and technical schools in a species of qualitative molecule-juggling which alone is of little practical use when tested in the furnace of the factory, where a quanitative control of every factor, and especially the physical and physico-chemical factors, is the sole condition of success. On the other hand comparatively few engineers in this country have in the past turned their attention to the design and construction of the special types of apparatus and the special modes of operation used in chemical engineering. How many of our young well-trained engineers have ever heard in the schools of the scientific principles which control the design of the apparatus used for filtration, evaporation, distillation, crystallization, and desiccation—to mention only a few types? How many of them have the faintest idea how to design a steel furnace, a multiple-effect vacuum evaporator, a ferro silicon furnace, or a liquid air rectifier?"

The question then resolves itself somewhat into a discussion of how much chemistry an engineer should know, or how much engineering a chemist should know.

Better Results by Co-operation

The technical chemist is expected to be cognizant of the inner workings of a great variety of industries—one day it may be a steam laundry trouble, the next a problem in embalming fluids. In this wide range of chemical problems the effects of mechanical handling are often the determining factors.

There are cases where plants have been erected by chemists with a smattering of engineering knowledge or by engineers with an inkling of chemistry. In either case there would have been far better results if there had been co-operation. In Canada until quite recently the engineer has not sought as freely as we would have wished, the co-operation of the chemist, and this is possibly a factor in the situation today, in at least one of our great industries whereby the financial backing for new mills of that industry has engaged engineering firms outside of Canada for their construction.

In an article entitled "Lessons for Chemical Engineers in Other Industries" (read at the Savannah Meeting of the American Institute of Chemical Engineers, December 1919, by A. E. Marshall) there are suggestive statements referring to wartime quantity production which are so well put that I again take the liberty of quotation as follows:

Chemical Plants Need Engineers for their Design

"A survey of the latest developments of chemical engineering leaves a sufficient reason for the suggeston that the chemical engineer should broaden his lines of study from the limited one of the purely chemical field to the wider viewpoint of engineering work and operation in other industries which present problems analagous to the manufacture of chemicals..... In the past, the average chemical plant has started out as a producer of one or of several standard chemical products, and with the development of the business, new but usually inter-related products have been added to the factory output. Invariably the original design was a complete unit, so that even an increase in the output of the original products necessitated the addition of separate complete units without the possibility of effecting economies through the use of labor-saving devices applicable only to tonnage movements. When extensions through the multiplication of products became necessary, the situation was much worse, as the new additions had to be located externally to the original plant unit, and the conveyance of materials produced in the original plant of the new units in which they were to be utilized was necessarily reduced to primitive forms of transportation. There are few industries today other than chemical manufacture which present the anachronism of manual handling the semi-finished product of one operation to its final point of utilization.

"A generalization of this nature must of course be qualified by exceptions in the case of plants designed to produce large tonnages of the low-priced chemical staples, or as they are more generally termed, 'heavy chemicals.' Such factories invariably have labor-saving tonnage movement devices, although they are not always in the forward state of development of the means used in other industries. . . . Some chemical plants built within the last five years will find it difficult to make extensions which permit of a lowered cost of production or even a cost equal to the original plant, for reasons such as lack of strength in the building structure preventing the employment of monorail cranes or similar mechanism to convey supplies of raw materials from the original storage bins or piles to the new extensions. Time can more profitably be spent in designing the present to suit the future than in trying to add in the future to a completed unit which has no outlets for expansion."

Two outstanding feats of chemical engineering bear on the remark as to the amount of engineering knowledge a chemist should have.

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*Consulting Chemist, Toronto.

Engineering Knowledge That a Chemist Should Have

One of these was Gayley's accomplishment of the task of removing water from the air used in blast furnaces. The little problem he tackled was the removal of moisture from 40,000 cubic feet of air per minute and he did it. It took him eighteen years, of which five years was spent in obtaining reliable data as to the moisture content of the air all day and every day for that time. He found that his 40,000 cubic feet of air per minute contained all the way from 73 gallons of water per hour in February, to 237 gallons per hour in June to each furnace.

Fourteen years after starting, he asked for $100,000 to make an installation and when he accepted the Perkin medal some years later, he said, "Here my most difficult work began, to persuade my associates that air did really carry moisture and that it could appreciably, even in the smallest degree, effect the working of a blast furnace," and even when he offered to pay half the expense himself, it was a year before he got the appropriation. In 1904, after eighteen years, the air drying apparatus was put in and when two-thirds of the air going to furnaces was dried, it was found that nine per cent. more ore and flux could be handled with no more fuel and in six months time a regular economy of fifteen per cent, was decided upon, though twenty per cent. had been found possible. The outcome of Gayley's work was a saving of about $25,000,000 annually to the American iron and steel industry.

When Dr. French, chemist of the Standard Oil Co., (whose process for taking sulphur out of petroleum oils, made the Canadian oil industry and raised the Standard Oil dividends from 7 per cent. to 40 per cent. on a hundred million capital, and Ohio oil from 14c to $1.00 per barrel), wanted to do a little work on the side, he took in the underground sulphur deposits of Louisiana. First, he bought the property, that was act of faith number one. Then he drilled a well to the rock with a 10 in. pipe and continued through the sulphur deposit about 200 ft. with a 9-inch drill and immersed a 6-inch pipe from the surface to the bottom and put a 3-inch pipe inside the 6-inch pipe. After taking some precautionary measures, the well was ready for the melting fluid which was water superheated to 335 deg. F. Putting down the well was act of faith number two and finally to get the volume of heat and steam at the 100 lbs. required, twenty 150 h.p. boilers were used. Dr. Frasch notes that this was "experimentation on a ponderous scale." All this was done on the faith without any precedent for guidance, relying only on the fact that sulphur melts at about 250 deg. F. Dr. Frasch pumped sulphur so readily out of that well that if he had not been as humane as he was scientific, there might have been a social disaster or revolution in Sicily as he could have undersold the Sicilian sulphur right in Italy.

I have cited these two classic cases to illustrate the great possibilities of chemical engineering. Perhaps these men might be called engineering chemists instead of chemical engineers but it only shows how little words mean.

Where Engineers and Chemists Might Co-operate

It might not perhaps be out of place to indicate some of the lines in which engineers and chemists could co-operate. In the large plants where quantity production is the keynote, the proper routing of materials—a sort of "flow sheet" to use the mining term—can only be arranged by mutual study of the process, properties, quantities and distribution. Each plant even if handling the same product by the same process has its idiosyncrasies, both mechanical and chemical. Many plants which consider it essential to retain a good lawyer and pay heavy fire insurance for years without having recourse to either, do not retain chemists or engineers because they cannot see any defect to remedy. These firms buy new machinery recklessly and the firms selling the machinery send their representative up and the installation is made with no reference to the balancing of conditions. Some mills have equipment in part of the plant for twice the output of some other part, thereby tying up capital and overloading the deficient equipment.

Another point is the need for co-operation between engineers and chemists, in the inception of new plants and throughout the consideration of layout. There is a pronounced tendency on the part of interests putting up new plants or extensions, to engage the contractor who erected their previous plant, who makes no corrections from experience of operation and the frequent result is the perpetuation of unsatisfactory conditions. In the interests of conservation of labor and material it seems advisable that no plant should be erected without co-operation of engineers and chemists, even in cases where processes are either essentially chemical or essentially engineering.

In large structural work such as bridges where the life of the structure depends in large measure on its protection from weather, careful field tests of paints should be made in the actual locality, and the shop coats should be specified only after the field coat is decided upon.

In the field of lubrication, there may be interesting developments at any time as we study the relations between molecules and their physical effects. How great a part does viscosity play, or the chemical composition of lubricants? We have been accustomed to think that there should be no free fatty acids in lubricants as they might tend to corrode the metal. We are now informed that small amounts of free fatty acids are much more effective than large amounts of the neutral oils from which they are separated. Roughly, the co-efficient of friction is lower with, say 99 per cent. mineral oil and 1 per cent. fatty acid than with 40 per cent. mineral oil and 60 per cent. of the neutral vegetable oil-rape, for instance. These figures are illustrative, not exact.

In this connection, the new hard lead alloy composed of lead with small amounts of barium and calcium and known as "Ulco," which was designed to replace antimonial lead in shrapnel, is claimed to be an excellent bearing metal in view of its high melting point, fine structure and low co-efficient of friction.

Chemists Rarely Consulted

Sometimes the design of a plant is good but the location and quantity of raw materials is unsatisfactory and the plant is often idle for lack of them or badly handicapped by variations in quantity or quality of raw materials. At other times an architect and contractor have been settled upon but the employment of engineer or chemist has been at their option and no provision made for them in the estimates. In some cases an engineer is appointed but I cannot recall any large piece of structural work for which a consulting chemist was appointed at the outset.

Metal Welding Processes and Methods

The Fields of Thermit, Electric and Autogenous Systems —Cutting by Oxy-Acetylene — Automatic Equipment

By W. H. Ludington*

During the last 25 years there has been developed a number of processes for the joining of metal parts, particularly the thermit, electric and oxy-acetylene processes. In the earlier stages of the development it was commonly believed by the metal trades that each of these processes was competing for the same field, and even to-day it is surprising the number of men indirectly or directly interested in the metal trades who still are of that opinion. Upon second thought it is quite obvious that if any one of these processes was adaptable to the entire field of welding, that process would have been developed at the expense of the other two, assuming, of course, that it would have covered the field adequately. Generally speaking, each of these processes has a field to which it is best suited, but it is to be expected that these fields will overlap in cases.

In the early days the manufacturers of the apparatus used in connection with each of the three processes claimed as large a field as possible for the use of their apparatus, and here let me point out that in the early stages it would have been impossible to have defined these fields, as the commercial interests behind the development were never certain that their particular apparatus had reached its full development; in fact, the same is true to-day, and by the introduction of a little ingenuity new fields for each process are opened daily.

In defining the field which the metal trades have found thermit, electric and oxy-acetylene welding best suited for, I will give you the benefit of the experience of Mr. A. M. Barry, managing director of the St. Lawrence Welding Company, Limited, Montreal, who use all of the three processes in the course of their work, and use the process best suited for the job they have in hand.

The Field of Thermit Welding

Thermit welding is used principally for large welds in steel or cast iron. There is practically no limit to welds that can be made in steel by the Thermit process, it handling very heavy sections, such as blooming mill press frames in the steel mills, enormous crankshafts, strong pressure frames, shear frames and rolling mill equipment, such as carbon rolls. It is possible by the Thermit process to build in very large panels and steel gears; also heavy press cylinders can be successfully welded by the thermit process. In other words, the very heavy welds that require high tensile strength is the thermit welding field. The reason for this principally is that the weld is made more or less automatically and is cast instantaneously, in fact, the reaction occurs in thirty-five seconds, and after the weld is poured we have a high grade chrome nickel steel weld of great tensile strength.

Electric Welding

The electric welding field is one of steel and iron only, the field being boiler or tank repairs. The advantage of electric welding over oxy-acetylene is due to the fact that the largest portion of the work resulting from wear on boilers or tanks occurs in the seams or those parts that have riveted construction, and as the electric welding heat is so concentrated, it is possible to place a weld close to rivets without disturbing the rivets in any way; in fact, a heavy weld can be built up on a seam without the plate becoming red hot. To do this by oxy-acetylene would mean a large area of the plate would become white-hot, a smaller area red hot, and we would have the rivet shanks heated up; the diameter of the rivet holes would become smaller owing to expansion; the rivet shanks would be squeezed out of the holes, and it would be impossible to permanently make these rivets tight without replacing them. The electric welding, therefore, has an enormous advantage over oxy-acetylene on this class of work. It also has a field in building up steel shafting that has become worn in the bearings. The method used is to add sufficient metal so that the shaft can be turned down to full size of the original bearing.

Generally speaking, however, oxy-acetylene welding has been found by the metal trades more adaptable than the electric welding for the heavier work, also where the physical properties of the weld is an important factor. While the oxy-acetylene flame has a temperature of 6300 F. and the electric arc is nearer 9000 F., in practice the same volume of heat is not available; therefore, the oxy-acetylene process, with its temperature of 6300 F. is capable of developing sufficient heat to melt a larger mass of metal and keep it in a plastic state while being worked with comparatively no danger of burning the metal.

The Thermit process requires a great deal of preparation and a mould for every case has to be made. Without referring to the relative expense the trade have found that all exceedingly large welds, and any welds too large for the oxy-acetylene process must be made with the Thermit process. It is interesting to note that the size of weld that can be made by this process is almost unlimited. There is a case on record of a casting being welded up to four tons, representing the weight of metal poured.

Autogenous Welding

The term autogenous welding is used to describe the type of welding made with the oxy-acetylene torch, the principle of which type of welding is that a certain mass of the metal of the parts to be joined is brought up to a plastic state, and is then caused to run together. The theory is that at this temperature, the metal expanding, the molecules separate and interlock, and practice substantiates this theory in as far as it is possible to make a weld, which after being broken, will not show any evidences of a join to ordinary observation. However, upon a microscopic analysis, say following an etching of the metals, the fibres of the weld will appear elongated. This is due mainly to the superiority of the adding material which is always a better grade of metal than the parent part, as the adding material is produced in smaller quantities under ideal conditions. The required temperature for heating the masses of metal is made possible with the oxy-acetylene welding torch by virtue of the size of flame, the heat of flame, and convenient manner in which the flame can be maintained. You will note that autogenous welding with the oxy-acetylene torch resembles fusion welding to a certain degree.

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*Of Davis-Bournonville Co., Ltd., Montreal, before Canadian Railway Club.

Application of Welding

The practical application of oxy-acetylene and electric welding processes in the field of manufacture is to replace riveting and other methods of making joints, and also in repair work under conditions where the older processes would have been wholly inadequate.

The rapidity with which the joints can be made in many manufactured articles and the comparatively high efficiency of the weld make it of great importance. For instance, in repair work it has made possible the saving of many parts which would otherwise have been scrapped, such as automobile crank cases and some special applications are found in the reclaiming of cracked casting in the foundries, the filling of blow holes in castings the adding of material to worn surfaces to secure the original thickness, the welding of pipe without removal, the filling of drilled holes that had been incorrectly located, and the sealing of riveted seams to secure absolutely tight joints which cannot be done effectively by caulking. In general, the more recent welding processes are used for producing reliable joints in thousands of manufaced articles which were formerly brazed, riveted or bolted together. In many fields the method has revolutionized past methods with corresponding decrease in labor and cost of production.

Cutting by Oxy-Acetylene

The oxy-acetylene torch is used for cutting out steel shapes, cutting holes in steel plates, cutting of risers from steel castings, cutting structural beams. and for cutting up steel wreckage. The torch used is similar to the welding torch, the main difference being that the cutting torch provides facilities for turnng a jet of oxygen on the metal to be cut after it is free heated.

The principle of cutting is to heat the metal with the oxy-acetylene flame to a red heat, then turn on a jet of pure oxygen, which burns away the metal. The cutting is undoubtedly a process of combustion. The cutting with the oxy-acetylene torch at present is practically limited to wrought iron and the different grades of steel, some of which cut easier than others, varying with the carbon contents and nature in which the carbon is found in the steel. The dropping of temperature, due to the forming of a slag on the surface of the kerf cut confines the combustion as desired, and the kerf cut is practically confined to the course of the jet of oxygen.

The development of automatic welding and cutting equipment has solved many difficulties for the manufacturer in such cases as welding automobile bodies, light gauge piping for use in building of automobiles, in the exhaust pipe gasoline manifold and steering post, also for the welding of gasoline tanks and steel apparatus for oil and gasoline. For instance, there is one machine on the market which will weld steel pipe at a speed greater than 16 feet per minute, making a perfect joint. By the use of one of these machines lighter gauge metals can be formed up and welded into piping, which results in a pipe of lighter gauge than seamless tubing, with a considerable reduction in the cost of the finished pipe. There is another machine for welding steel barrels. The weld itself is far superior to the ordinary weld made with the hand torch, and there is no comparison in the speed. In automatic cutting equipment there are machines on the market at present specially adapted to cut thicknesses of metal up to ten and 12 inches, the torch being controlled on the pantagraph arm, and the tracer propelled with an electric motor which results in a constant speed in the movement of the cutting torch, which accounts for the remarkably smooth cut that is made; in fact the cut in metal with automatic cutting equipment compares favorably with any roughing tool. Another automatic cutting equipment I have in mind is a machine in which the torch is carried on a small carriage propelled by an electric motor, the wheels running in a track. This machine is adaptable to the cutting of circles by using a radius rod, and is used largely in shipbuilding for trimming plates. There are also other machines for making circular cuts, such as port holes, holes and cams in tracks and trimming boiler heads.

The temperature of the oxy-acetylene flame is computed to be about 6300 F., and is the highest possible temperature obtainable with gases, as perfect combustion is taking place between carbon, the pure fuel and oxygen. When you consider that the melting point of cast iron is approximately 2100 F., soft steel 2600 F., and wrought iron 2700 F., the temperature obtained with the oxy-acetylene flame is sufficient to readily melt any of these metals.

Types of Torches

All the welding torches in use to-day can roughly be classed under two headings, the injector type and the medium pressure type. In the case of the injector type, the acetylene is fed to the torch at very low pressure, ranging from one to six ounces. In the medium pressure torch the acetylene is fed to the torch at a pressure of from one to six pounds. The actual pressures in each case depend upon the size of tip, which in turn depends upon the thickness of metal to be welded.

The temperature of the oxy-hydrogen flame is about 4000 F. as compared with the Oxy-Acetylene flame at 6300 F. In this connection it is interesting to note that the number of British-Thermo-Units per cubic foot of gas of the oxy-acetylene flame is five times as great as the oxy-hydrogen flame.

Oxygen

Oxygen is generally obtained from suppliers in steel tanks, one, two and three hundred cubic feet capacity, with the gas compressed to approximately 1800 pounds. It is of considerable importance that the oxygen should be as pure as possible. The impurities which decrease efficiency are nitrogen or hydrogen. When oxygen is prepared by the liquid air process. a certain percentage of nitrogen is always certain to be present. Nitrogen tends to cool the heating flame. In the manufacture of oxygen by the electrolytic process, the only impurity is hydrogen. The effects of the presence of nitrogen are especially noticeable when cutting operations are done by the oxy-acetylene or oxy-hydrogen cutting torch. Experiments have been carried out in order to determine just how serious the effect of nitrogen is. These experiments show that the purity of oxygen plays a most important part in the efficiency with which the cutting operations may be accomplished. S. W. Miller, a recognized authority, claims that with oxygen about 85 per cent. pure, it requires about three times as long to cut a plate an inch thick as when the oxygen is 99 per cent. pure. Even the one-half of one per cent. drop from 99 per cent. oxygen to 98.5 per cent. quality means a decrease in efficiency of 16 per cent. Hence, even if the better grade of oxygen costs more, it is apparent that this expense is justified. It will readily be seen from what has just been said that the best oxygen commercially is produced electrolytically, and even considering the guarantee given by the manufacturers of either of these processes, as to purity, is evidence enough that where possible oxygen from the electrolytic process should be used.

Acetylene

Acetylene gas can be obtained in tanks containing 100 or 300 cubic feet, at a pressure of 225 lbs. All acetylene gas is made by slaking calcium carbide with water. However, if acetylene gas is used in any quantity, it is cheaper, and a better gas is obtained by the installation of a generator.

Fluxes

Those who are familiar with oxy-acetylene welding are aware that fluxes, scaling powders, are used; but it is not generally known why the use of these fluxes is necessary. They are sometimes used in the shape of powders, into which the welding-rod is dipped, thereby transferring the flux to the weld, or they may be incorporated in the welding-rod itself. Also a special welding-rod containing certain elements may be used in connection with a powdered flux. Inasmuch as each metal has different characteristics and requires different treatment during the welding process, the nature of the flux varies with the metal. Therefore it would be well to consider each metal separately, first explaining the nature of the difficulties encountered and then describing the remedies which are applied, including, as far as possible, the materials used for making the fluxes. It should be stated here that the manufacture of satisfactory fluxes requires considerable chemical knowledge, and in the majority of cases, should not be undertaken by a welding shop, because of the difficulty of obtaining the proper amount of the necessary elements and mixing them properly, and because it is cheaper, as a general rule, to buy the fluxes from the manufacturers than to attempt to make them.

The use of flux in the case of aluminum welding is particularly interesting, inasmuch as it has only been recently developed. The difficulty to be overcome is that the oxide of aluminum is considerably heavier than the metal itself, and the use of a flux is necessary to eliminate this oxide. The flux used must be a very active agent, and is comparatively complex chemically. It is enough to state that satisfactory fluxes have been produced for aluminum. Welding can be done if the necessary precautions are taken and proper fluxes used.

The industry of welding and cutting has developed to the point where no machine shop can be considered complete without a welding apparatus, either electric or oxy-acetylene, and a cutting equipment, either hand equipment or automatic.

Constitution and By-Laws of the A. C. B. C. I.

Code Governing the Policy, Activities and Operation of the Body Representing the Building Industry in Canada

THE constitution and by-laws of the Association of Canadian Building and Construction Industries have now been finally approved and adopted and are printed herewith. It is planned to provide in the Association a united organization, mobilizing the strength and experience of the various branches of the building and construction industries of Canada, to serve as an exchange and common meeting-place for the various special interests. In matters of policy, propaganda, legislation and investigation the endeavor will be to reduce the difficulties encountered, to improve practice, to fix standards, to facilitate the movement and employment of labor, and to increase the production of materials. The constitution follows:

Article 1—Name

This Organization shall be known as "The Association of Canadian Building and Construction Industries," hereinafter referred to as the "Association."

Article 2—Purpose

The object of the Association shall be:—(a) To promote better relation between the members on the one hand; and owners, architects and engineers, on the other; (b) To establish and maintain standard methods of practice between the members within the industry; (c) To acquire, preserve and disseminate valuable information concerning the industry; (d) To extend construction and improve conditions in the combined industry. To co-ordinate the units of the industry in its producing, manufacturing, distributing, professional and constructive activities, thereby increasing its efficiency and extending its usefulness, to the end that the industry shall be stabilized.

Article 3—Membership

Section 1. Membership in the Association shall be of two classes, (a) "Collective," and (b) "Individual."

(a) "Collective" Members. Any group of individuals, firms or corporations engaged in any of the building or construction industries, either local, provincial or national, organized into such bodies as Builders' Exchanges, Trade Associations, or branches of such bodies as Boards of Trade pertaining to any of the building or construction industries, may become members of the Association.

(b) "Individual" Members. Any individual, firm or corporation engaged in any branch of the building or construction industries shall be eligible for membership.

Section 2. Plural Membership:—Any "Individual" or "Collective" member shall have the privilege of obtaining multiple memberships.

Section 3. Regulations:—(a) Applications for membership shall be passed on by the Executive Committee under such regulations as it may adopt.

(b) Any member may withdraw from the Association by submitting to the president a written thirty day's notice of resignation.

(c) A certificate of membership shall be issued to each member upon election.

Section 4. To facilitate the objects of the Association the membership may be organized into four sections, viz.: (a) General Contractors and Contracting Engineers; (b) Trade or Sub Contractors; (c) Supply Firms, Manufacturers, and Producers of building material and plant; (d) Members of Allied Professions, including Architects, Engineers, Town-planning and Research bodies. Each section may be further sub-divided.

Section 5. Representation:—Whereas this Constitution aims at giving representation to all existing organizations interested in the building and construction industries, as well as individuals, it is recommended that existing organizations, where possible, re-organize themselves into, and new organizations where formed become, branches of this Association under the regulations here laid down for "Collective" members.

This course is recommended with the aim that the country may be organized into local groups, which would in turn form provincial groups and each of these in turn elect three official representatives, who combined with the elected officers would form the National Council.

Article 4—Annual Fees

Section 1. Membership fees for "Collective" or "Individual" membership, including multiple memberships, shall be twenty-five dollars ($25.00) per annum for each membership, payable upon election, and annually thereafter on the second day of January.

It is provided, however, that in the case of provincial or other similar groups of organizations, where same are formed of "Collective" members, they shall not be expected to pay a further membership fee.

Section 2. Arrears.—If any member shall fail to pay his annual fee within six months after same has become due, registered notice to his last known address shall be sent him by the secretary, and if after such notice the fee be not paid within thirty days, such member shall be suspended from all privileges of membership. The Council may, for cause deemed by it sufficient, extend the time for payment and for the application of these penalties, and may reinstate such member upon payment of all arrears.

No member who is in arrears with his dues shall be entitled to vote.

Article 5—Meetings

Section 1. Annual General Meetings:—The fiscal year of the Association shall commence on the first day of January of each year and the annual general meeting shall be held within eight weeks succeeding said date. It shall be convened in such place as may be decided upon by the national council, to receive reports of officers and committees, to elect officers, committees, and a national council for the ensuing year, and for all other general or special purposes relating to the management of the association's affairs.

Section 2. Special General Meetings:—Special meetings of the Association shall be held upon request of the majority of the members of the national council, or twenty-five per cent. of the members of the Association. Notice of all special meetings shall be sent by the secretary of the Association to each "collective" and "individual" member at least thirty days prior to the date of meeting—such notice to state the object of the meeting and the subjects to be considered, and no other subject shall be considered at such special meeting.

(Note:—It was understood, when this clause was adopted, that the voting powers of members, at the annual general meetings or at special general meetings should be based on actual attendance. For example, if a member holding ten memberships came alone to the meeting, he would be entitled to only one vote, but if ten representatives were present, each would be entitled to a vote.

It was further understood that there was no provision made for members to vote by proxy.)

Article 6—Government and Election

Section 1. National Council:—The affairs of this Association shall be managed by a national council, composed of the five officers elected at the annual general meeting, and three councillors from each of the provinces of the Dominion of Canada.

Section 2. The three provincial councillors shall be elected by the provincial association, representing all memberships in each respective province, in such manner as will provide for continuity of office. These councillors shall be elected prior to the annual General meeting of the Association.

(Note:—It was understood, when this clause was adopted, that in a province where no provincial organization exists, the councillors shall be elected as follows:

(a) If there is only one local builders' organization, the three councillors shall be elected by that body.

(b) If two local organizations exist, the larger body shall be entitled to elect two councillors, and the smaller body shall elect one.

(c) If there are three local organizations, one councillor shall be elected by each body.

It was further understood that each province should have equal voting power in the meetings of the national council, the representative present from any province being entitled to exercise the three votes, if necessary.)

Section 3. The national council shall have supervision of all the affairs of the Association and shall have full powers of the Association between general meetings, and may adopt such rules and regulations for the conduct of its business as shall be deemed advisable.

Section 4. The national council shall maintain facilities for continuous communication with the individual members of the several trades and occupations through the local and provincial organizations; and shall provide that the council shall at all times know what are the practical problems and needs in the several districts and industries, that the members of the Association everywhere may know accurately and promptly what the council is doing and is prepared to do, and that all concerned may have convenient means of co-operation for the common end.

Section 5. The national council shall meet and organize as soon as practicable after the election of the officers. It shall further meet upon call of the president at such times and places as he may designate, but shall be called to meet at any time upon the demand of the majority of its members. Notice of all special meetings of the national council shall be sent by mail or telegraph, so as to reach each member at least two weeks in advance of such meeting.

Article 7—Officers

Section 1. The elective officers of the Association shall be: President; first vice-president; second vice-president; honorary secretary; and honorary treasurer. They shall be elected at the annual general meeting by ballot, and shall serve through the next annual meeting and until their successors are elected and installed. A majority of votes cast shall elect.

Article 8—Duties of Officers

Section 1. The president shall preside at all meetings of the Association and of the national council, hereinafter provided for; he shall be a member, ex-officio of all regular and special committees, shall have general supervision of the affairs of the Association and shall perform such other duties as are usual for such an officer.

Section 2. The first and second vice-presidents shall, in order, perform the duties of the president in the event of his temporary disability or absence from duties. In the event of permanent disability or death of the president or any vice-president, the vacancy shall be filled by the vote of the national council.

Section 3. The honorary secretary shall attend all meetings, assist the president and co-operate with the general secretary.

Section 4. The honorary treasurer shall be custodian of all moneys of the Association, and shall disburse moneys only upon written orders signed by the general secretary, and countersigned by the president or someone delegated by him to perform this duty, which shall be his only voucher for disbursements. He shall carefully account for all transactions of his office, and shall make full report of the same to the annual meeting or at any time upon demand of the president. He shall submit a report from a chartered accountant whose appointment shall be made in accordance with Article 12.

Section 5. The general secretary shall be appointed by the executive committee of the national council. It shall be his duty to devote his time and efforts to organizing and promoting the objects of the Association and extending its membership and influence.

Section 6. The general secretary shall receive all moneys, carefully account for the same and immediately transfer them to the honorary treasurer, taking the treasurer's official receipt therefor; keep a complete and accurate record of all proceedings of the Association, as well as of the executive committee and national committee. He shall have the custody of the seal of the Association, and shall keep the books, papers and records of the Association, all of which he shall deliver up when directed to do so by the president of the executive committee, to such person as he or they shall direct; and shall perform all duties which the nature of his office may require, or the executive committee may order. He shall attend to the publication of all reports, conduct the official correspondence, attest documents, and may with the approval of the national council, delegate to assistants any portion of the duties herein set forth.

Section 7. All officers or employees handling money on account of the Association shall be bonded in such amounts as may be determined by the national council. The expense of furnishing such bonds shall be paid by the Association.

Article 9—Executive Committee

The executive committee shall consist of the five elective officers of the Association, viz:—president, first vice-president, second vice-president, honorary secretary and honorary treasurer.

The president shall be chairman of this committee. Between the meetings of the national council this committee shall have supervision of the affairs of the Association.

The executive committee shall actively prosecute the objects of the Association, and shall have discretion in the disbursement of funds. It may in the execution of the powers granted appoint such agents as it may consider necessary, and fix the number, title and compensation of employees.

Vacancies in the executive committee shall be filled by the national council.

Article 10—Committees

Section 1. The committees of the Association shall comprise one standing committee each on (a) business relations; (b) labor; (c) standing practices, and any such other standing or special committees as the national council may see fit to create.

Section 2. The president shall appoint, with the advice and consent of the executive committee, such standing and special committees as shall have been authorized by the national council.

Section 3. At the annual meeting, the chairman shall appoint a nominating committee, consisting of one member from each province represented, who shall proceed to nominate the candidates for the elective offices.

As soon as these nominations have been agreed upon, they shall be filed with the secretary, and posted in the convention hall.

Section 4. Independent nominations may also be made at the convention by five of the voting members present, by posting in the convention hall a signed statement making each nomination.

Article 11—Order of Business

The order of business at all meetings of the Association or of the national council shall be as follows:

1, Report of attendance; 2, minutes; 3, business arising out of minutes; 4, receiving communications; 5, secretary's report; 6, treasurer's report; 7, president's address; 8, report of standing committees; 9, report of special committees; 10, unfinished business; 11, amendments to by-laws; 12, election of officers and committees; 13, new business; 14, resolutions; 15, notices of motions.

This order of business may be suspended or varied at any meeting by a two-thirds vote of the members present.

Article 12—Audit

An auditor shall be appointed every year by the members at the annual general meeting, whose duty it shall be to audit the books, vouchers and accounts of the Association, to certify to the correctness of the balance sheet, to examine the securities in the possession of the treasurer, and to certify to the reasonableness of the valuation at which the Association's assets are carried. His remuneration shall be fixed by the executive committee.

Article 13—Seal

Documents issued by the Association shall be certified with the seal of the corporation, which shall con-

No. 14

Canada's Contractors—Jas. Mackie

At the conference of the Association of Canadian Building and Construction Industries, held last February in Ottawa, there was no stronger or more enthusiastic advocate of the general principle of "organization" in the industry than James Mackie, president and manager of James Mackie Company, Ltd., plumbing and steam and hot water heating specialists, Winnipeg, and his election as second vice-president of the A.C.B.C.I. for the present year, was a recognition of his ability to serve on the directorate of the organization representing Canada's second largest industry. Mr. Mackie has been untiring in his efforts to put the construction business on an organized basis. At the convention his deliberations carried much weight and his arguments were marked by a sane viewpoint. He has no pessimism in his make-up, when it comes to discussing the prospects of the building and construction industries—that is, providing they are effectively organized and equipped to occupy the position to which they rightfully belong in the economic status of the country.

Mr. Mackie is a Torontonian and served his apprenticeship with Keith & Fitzsimmons, heating specialists. From 1895 to 1905 he resided in Montreal and then moved to Winnipeg, where he was for five years manager of the R. H. Tears' plumbing and heating business. In 1910 he started into business for himself, under the firm name of James Mackie Company, Limited. As he says himself, he has had a lot of hard work with his fair share of contracts. We hope this will continue—at least as regards the contracts. Mr. Mackie made many friends at Ottawa who will look forward to the next annual convention all the more on account of the opportunity of renewing the acquaintance.

Mr. Jas. Mackie,
2nd Vice-President, A.C.B.C.I.

sist of an embossed die in circular form containing the name of the Association in the outer circle, with the date of incorporation in the centre. The general secretary shall have custody of the seal of the association.

Article 14—Amendments

The by-laws of the association may be amended by a majority of the members of the Association presented at any annual or special meeting called for that purpose, notice of such amendment having been given in writing to the secretary at least one month prior to the date of the meeting, and it shall be the duty of the secretary to forward to the members a copy of such amendment. Amendments to the amendment may be discussed and voted on at the same meeting.

Public Works in St. John, N. B.

DURING 1919 the city of St. John, N. B., through the Harbor and Water and Sewerage Departments carried out the following work according to information supplied by the city engineer:

The Harbor Department, in addition to ordinary maintenance, practically reconstructed North Rodney wharf. The work was carried out by Engineers & Contractors, Ltd., and the total cost was $29,310. The West Side Ferry approaches were sheathed at a cost of $19,814, the work being done by Messrs. Robt. Roberts' Sons. A new deck was also put upon what is known as Cross Wharf, the work being done by R. R. Lee at a cost of $2,906. Some improvements were also made to the East Side Ferry approaches with a view to later on widening the approach, at a cost of $3,171, the work being done by Herbert S. Mayes.

During the year 17,564 lin. ft. of new water mains was laid as follows: 10,863 ft. of 16 in., 2,518 ft. of 12 in., 3,937 ft. of 8 in., 106 ft. of 6 in., and 125 ft. of 4 in. There were removed or abandoned 10,117 lin. ft. of mains, as follows: 3,345 ft. of 12 in., 3,164 ft. of 10 in., 1,139 ft. of 8 in., 1,275 ft. of 6 in., 794 ft. of 4 in., and 300 ft. of 3 in. The department laid 5,674 lin. ft. of tile pipe as follows: 1,821 ft. of 15 in., 878 ft. of 12 in., 2,936 ft. of 9 in., and 12 ft. of C.I. pipe, and built 41 manholes. 3,245 lin. ft. of old wooden sewer was abandoned, 6 manholes removed and 8 new catch basins built. There were also 52 new gate valves in the water system installed and 27 abandoned, a net increase of 25 gates, making a total of 2,043 gate valves in the service.

One new fire hydrant was set and ten 1-way hydrants were replaced with 3-way hydrants.

Asbestos Industry in Quebec

The asbestos mining industry in the Province of Quebec, Canada, has grown from a production of 5,919 tons in 1888 to 141,462 tons in 1918, a period of thirty years. The 5,919 tons produced in 1888 were valued at $352,260, an average price of $59.51, while the 141,462 tons in 1918 were valued at $8,936,809, or an average price of $63.17. It is interesting to note that the average price in 1888 was higher than the average price in 1917 ($52.45). It is, of course, very probable that the material produced in 1888 was mostly high grade, either crude or mill fibre.

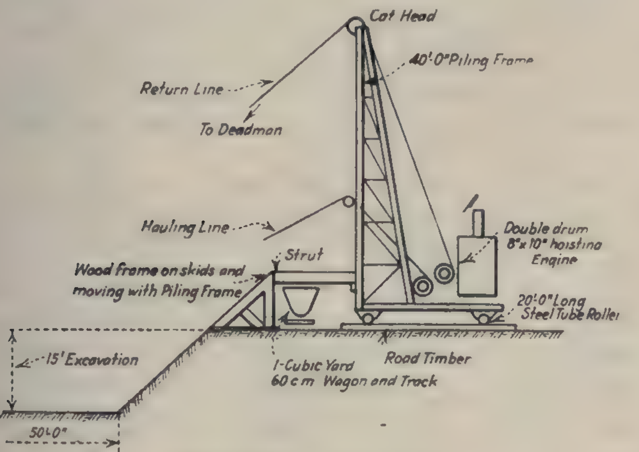
Hints for the Contractor

That May Save Him Time and Money—We Will Pay for All Accepted Items—Send One In

Drag Line Excavator Made From Piling Frame and Hoisting Engine

IN excavating a pump chamber near Belfast, Ireland, an ingenious method was employed. Six-inch timber sheet piling was to be driven, cut off 15 ft. below the ground level in a pump chamber 160 ft. by 50 ft. and the chamber excavated to the 15-ft. depth. The ground was heavy and sticky, somewhat similar to what is called "Gumbo" on this side of the Atlantic.

The fact that the trench was 50 ft. wide, made timbering difficult and expensive, so it was decided to excavate as an open cut with side slopes of approximately 1½ to 1. To do this a home-made dragline excavator was made by a combination of a double drum 8-in. by 10-in. hoisting engine and the piling frame which was brought to the job early and used as the tower.


Cat Head
40'-0" Piling Frame
Return Line
To Deadman
Hauling Line
Strut
Wood frame on skids and moving with Piling Frame
Double drum 8"x10" hoisting Engine
20'-0" Long Steel Tube Roller
15' Excavation
1-Cubic Yard 60 cm Wagon and Track
Road Timber
50'-0"

Piling frame in use as tower

The equipment was rigged up as shown in the accompanying sketch from "Successful Methods" and after the excavation was finished, the piling frame was lowered into the cut and the piles driven. A considerable saving was effected and the job speeded up materially.

This utilization of the piling frame as a tower during the excavation work kept it busy nearly 100 per cent. of the time instead of leaving it idle until the time came for driving the piles.

Portable Camp Building

A PORTABLE building that can be taken apart readily and shipped to another location if desired, thus making it applicable to other temporary or semi-permanent locations, is employed by the Chicago & Northwestern Ry. for housing maintenance of way construction crews. The building illustrated was described in a paper read before the American Railway Bridge and Building Association.

The structure is 8 ft. by 16 ft. over all with a shed roof 7½ ft. high on one side and 8½ ft. on the other. The sides, ends, floor and roof are separate pieces for convenience in handling, transportation, erecting or taking down. It is stated that the building can be taken down and loaded on cars at a cost not exceeding $5, and that it can be unloaded and erected at a new location for a like amount.

Hints for Road Grading

SUGGESTIONS on equipment for highway grading were given by Mr. Richard Hopkins, in a paper presented at the annual convention of the American Road Builders' Association. The following is taken from the paper:

Jobs where the excavation exceeds 5,000 yd. per mile, and where a large proportion of the hauls are long, will generally call for a steam shovel. Where hauls are short and cuts small, scraper work will continue to hold first place. No grading job is complete without wheelers, drag-scrapers, fresnos, and at least one road machine.

Each of the three types of scrapers is more economical than either of the others under certain conditions, and for the small extra investment in plant, it is foolish to be without at least a few of each one of the three kinds. Most contractors have in the past erred on the side of having their wheelers too large and their drag scrapers too small. The fresno of a 4-ft. width is the proper size for the average job. In case of shovel break-down, the teams can be put on scrapers until shovel is repaired. The road scraper is the most maligned, and the most neglected grading tool we have. A good operator is essential, and with one, much good finishing work can be done cheaper than by any other method. There is a big range of sizes available, so it is an easy matter to choose the one best suited to the particular job.

Rough and Finished Grading Together

It is advisable to carry rough grading and finished grading along together, as the latter can always be done more cheaply while the dirt is mellow. Specifications are growing more stringent in the matter of rolling in thin layers. This requires a big labor expense on the dump, especially with steam shovel work. A team on a 4-ft. fresno will take the place of six men on the dump, and spread the dirt evenly for the roller. In this connection it is well to remember that aside from a steam roller nothing has been found that equals the compacting effect on a fill as horses tramping over it.

The rotary grader has been on the market only a short time, but large capacity and cheap costs have been reported. It works rapidly in loam or gravel, and cuts accurately to grade. It also cuts old macadam readily, and a stone screening attachment can be provided if a contractor desires to save the old crushed stone.

The old time rooter plow and scarifier are tools that will always be used when a small amount of old macadam is encountered. Most plow companies now make a heavy mold board plow with a narrow cut that is more successful in real hard pan than a rooter plow.

In shallow cutting with a steam shovel on old macadam, it will generally be found best and cheapest to cut a few inches below grade, and dump every third or fourth dipperful behind the shovel for the fine graders to bring the subgrade back to the correct elevation. Where a roller is fitted with a scarifier attachment it is sometimes found that a lot of expensive hand work can be saved by its use.

Mainly Constructional

East and West—From Coast to Coast

Montreal is to borrow $3,000,000 from the Provincial Government this year for housing purposes.

A recent report states that construction of 1,600 houses was commenced in 1919 under the Federal housing scheme, of which number, 1354 were completed.

After being closed for the past two years owing to war conditions, the Frontenac Floor & Wall Tile Company, Limited, of Kingston, Ont., has resumed operations.

The lathers demands, at Toronto, for 90 cents per hour until May 14, and after that date $1.00 per hour for the usual 8-hour day has been agreed to by the contractors.

A by-law to raise the sum of $371,000 for the purpose of erecting a rapid sand gravity filtration plant at the city of Chatham was defeated recently by the ratepayers.

By a vote of 608 to 61, ratepayers of Orillia, Ont., passed a by-law granting the Glasscoat Sewer Pipe & Conduits, Ltd., who contemplate erecting a factory in the town, a free site and a fixed assessment for ten years.

The first annual dinner of the Builders' Exchange of Quebec City, held in the Chateau Frontenac recently, was a big success, over 200 being present, including several members of the Montreal Exchange, and several well known public officials.

Building permits issued at Winnipeg for the month of March totalled $559,900 in value, bringing the total for the first three months of the year to $766,300, which shows a big increase over the corresponding three months of 1919, which was $162,750.

The personnel of the newly organized Housing Commission of Guelph, Ont., is as follows: Mr. D. M. Sanson, chairman; Mr. C. L. Dunbar, vice-chairman, and Mr. Geo. M. Yates, secretary. The commission has tenders on the first twenty houses on their program in hand.

Representatives of twenty-seven of Toronto's largest manufacturing concerns met recently at the King Edward Hotel and formed a Toronto Chapter of the American Steel Treaters' Society. The branch will hold regular monthly meetings for the discussion of new ideas, methods and equipment used in the heat treatment of steels.

It is estimated that the house building program of the border cities of Windsor, Walkerville, Sandwich, Ford City and Ojibway for this year will include about 1,000 houses at a total cost of $4,500,000, according to plans of the Border Chamber of Commerce, Windsor City Council and different manufacturers. This program is divided as follows: Windsor, 500 houses, $2,000,000; Walkerville, 300 houses $1,500,000; Ford City, 100 houses, $500,000 and Ojibway, 100 houses, $500,000.

Personal

Mr. G. S. Sherman, of Shelburne, N. S., has been appointed by the Provincial Highways Board, acting divisional engineer of Yarmouth and Shelburne Counties.

Mr. J. C. Pringle, of Hamilton, has gone to Timiskaming, Que., where he has accepted a position as assistant engineer in connection with an extensive sulphite mill and hydro electric power development undertaking.

Mr. F. P. Moffatt, C. E., of Winnipeg, for many years senior divisional engineer on the Hudson Bay Railway, has received an appointment in the Department of Railways and Canals. Mr. Moffatt has taken up residence in Montreal.

Mr. Thomas Adams, town planning adviser of the Commission of Conservation, Ottawa, arrived in Vancouver recently, after an extensive tour of several of the principal western cities of the United States, to which he is acting in an advisory capacity on town planning matters.

It is reported that Mr. J. B. Tyrrell, the well known mining engineer and economic geologist, of Toronto, has been appointed consulting engineer for the National Mining Corporation of London, England. This company was organized but recently with a paid up capital of $10,000,000.

Mr. J. H. Bower has resigned as general superintendent of the Engineering Branch of the Department of Soldiers Civil Re-establishment. Mr. Bower's work, while with the Department, was chiefly in connection with the design and construction of Canada's war hospitals. Mr. Bower has been appointed chief engineer of a large Montreal contracting firm.

Mr. W. A. Bowden, B.A.Sc., chief engineer of the Department of Railways and Canals, Ottawa, has been selected by the Dominion Government as consulting engineer on the International Joint Commission, in connection with the projected development of the St. Lawrence River between Montreal and Lake Ontario. The United States Government has also appointed an engineer, Lieut.-Col. Wooton, to represent it in a like capacity on the Commission. These two engineers will co-operate in the preparation of the necessary plans, surveys and estimates of cost of this development.

Obituary

Mr. Thomas Crawford Irwin, builder and contractor of Peterborough, Ont., died at his residence, 504 Stewart St., recently, at the age of 72 years.

Ald. Harry Phelan, of Peterborough, Ont., died recently at his home, following a short illness. Ald. Phelan was chairman of the Board of Works and has been a member of the Peterborough City Council for many years.

Mr. George Giles, general manager of the Vancouver Engineering Works, Vancouver, died recently in that city in his fifty-first year. Mr. Giles was honorary president of the British Columbia Metal Trades' Association and took an active part in the industrial development of British Columbia.

Trade Incorporations

Builders, Limited, with head office at Montreal, capital $20,000, to carry on the business of general contractors and builders.

Interprovincial Clay Products, Limited, with head office at Toronto, capital $500,000, to manufacture brick, terra cotta, tile, sewer pipe, etc.

Franco-Belgo Canadian Syndicate, Limited, with head office at Montreal, capital $40,000, to manufacture brick, tile, cement, sewer pipe, etc.

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Mechanical Equipment as a Means of Keeping Down Labor Costs

ARGUMENTS convincingly in favor of mechanical methods of loading over hand methods are presented in an article in this issue, by P. Philip, district engineer of the British Columbia Department of Public Works. An analysis is there made of four schemes of handling road gravel from the pit, the merits of each being determined by a comparison of the costs of loading. The author of the article in question recites his experiences with all four methods and finds that the cost of loading gravel per cubic yard for one type of mechanical loader is 12.3c, under average conditions, and 6.6c, under more favorable conditions; for clamshell, 6.8c; for team and scraper, 14c, and for hand shoveling, 27c. This is amply sufficient to show that hand shoveling is the most extravagant method of loading. To take all the factors into consideration, the author makes a comparison between hand and mechanical methods on a 16 cu. yd. basis, considering the cost of motor truck haulage. In this case the cost of handling 16 cu. yds. by mechanical loader is $4.97 as against $14.70 by hand. These figures are a fair comparison of the merits of the two schemes and are sufficient justification for discarding the slower and more strenuous method.

There should be no question about the advantage of mechanical equipment for such operations as loading. Long experience has demonstrated the reliability of machines, their ease of operation and their ability to dispense with a large proportion of costly labor. Hand methods were good enough in those long past days when labor was cheap and could be obtained for the asking. To-day labor cost is well nigh out of sight, and the supply is insufficient to meet the demand. Mechanical equipment—and there are machines to meet every need—will, when properly applied, largely solve the problem of high costs. Any contractor who has kept close tab on the costs of various methods of doing work will be convinced that a machine will, in general, do more satisfactory work and a greater volume of it than a man.

Colored Concrete in Greater Demand as Decorative Medium

THE increase in the use of concrete in pre-cast units as a building trim, in place of stone and terra cotta, has created a demand for a satisfactory method of coloring the material to obtain greater aesthetic value. In this connection an article in this issue, giving the practical experience of its author in the manufacture of building trim, contains some excellent suggestions on methods of producing permanent and satisfactory color effects.

The standard method of using grey and white portland cements, either alone or mixed, adding suitable pigments, gives excellent and uniform results, but great care is necessary to properly mix the cement and pigments to avoid a reduction in the strength of the concrete. More often the natural color of the aggregate is depended upon to secure a suitable color.

The possibility of employing the absorptive qualities of concrete during the stage of curing and seasoning is pointed out by the author in the article in question. Capillary action will cause a coloring solution to enter the surface of concrete to a depth of six inches or more, if the object is immersed while in a very green state. For practical purposes, however, penetration to a depth of one-eighth of an inch or less is all that is necessary and it is possible to so employ coloring solutions to get very excellent effects. The author recommends metallic solutions as the beauty of color is increased by oxidation such as takes place on real metal surfaces. It has, indeed, been found that surfaces treated by this method become so hard and dense that they will take a polish like marble, granite and metal. Certainly the possibilities of this treatment are unlimited, provided good judgment is used in the matter of coloring values and care is taken not to impair the strength requirements of concrete.

In the article, it is also pointed out that excellent results have been secured by the application of waterproof paints. Common concrete can be made very attractive by one or two coats applied in stipple fashion. Color effect obtained in this manner is the most economical. It is a uniform color, but does not give the richness and depth of shading that results from immersion treatment.

By combining these methods, the artistic possibili-

Shall We Divide Canada?

IN 1867 our fathers consummated at great price a union of all the provinces and interests of Canada. For over half a century the provinces of Canada have developed together, each the component of the other.

Canada must be bound together as it is to-day, not so much by the machinery of government as by ideas held in common by all and freely exchanged, so that all sections sympathize with each other. This result has been accomplished primarily by the press, particularly the weekly and monthly periodicals and business papers.

They have no local or sectional bias.They go to all parts of the Dominion. They serve all parts alike. Their service is in bringing all provinces close together into one great nation through one common understanding.

Canada must not be split into half a dozen sections—weak with the evils of sectionalism, disastrous in the extreme—overflowing with narrow provincialism.

Emanating from we know not whither, comes an idea that will rip asunder all the good done in over half a century of patient building.

It is proposed to tax the very thing that has bound Canada into one—to place on the nation-binding press a zone postal tax which would increase the postal charge upon national periodicals as high as 800 per cent. It means loss to you personally and a loss to your country. It will weaken, cripple and in some cases destroy Canadian national periodicals. You will be deprived of papers that have kept you informed on your country's problems, your business problems—that have helped you in your work. Such magazines as do survive will cost you much more.

The publishers are not trying to evade fair taxation. They will gladly accept any fair tax upon their profits.

But is it fair that you should be taxed out of getting journals, papers and magazines that have helped you build your business and in turn built the business of the country?

If you believe in national ideals and national periodicals, sign attached form.

Tear off and mail to-day

CONTRACT RECORD,
347 Adelaide Street West, Toronto, Ont.

I am opposed to any zone postal law which would mean charging higher subscription rates to subscribers, according to distance from office of publication.

Name ... ...

Address ... ...

ties of concrete trim are limited only by the color sense and taste of the craftsman. Certain parts of an object can be painted before subjection to the coloring bath, the parts so colored not being affected by the coloring absorbed by capillary action. The absorptive qualities of the aggregate can also be used to gauge the final coloring after treatment in an immersion bath.

There seems to be plenty of scope for the exercise of ingenuity and skill in the production of colored concretes. There is a growing demand for decorative concrete to replace the more costly cut stone and terra cotta, but hitherto concrete has been tabooed by architects and owners on account of its plainness. The proper study of coloring methods, however, may pave the way for a more widespread application.

Offsetting Increased Cost of Labor and Material in Waterworks Operations

THE water works department of Lynn, Mass., has met increases in wages and cost of materials of 75 to 100 per cent. during the last four years without increasing its rates or any increase in the amount of water sold. How this was accomplished is described by Mr. Reeves J. Newsom, Commissioner of Water Supply of Lynn, in a paper before the March meeting of the New England Water Works Association. An abstract of the paper follows:

The writer took charge of the water supply system in July, 1916, and found an ample field for the application of engineering principles to the methods of operation. The improvements noted are of the kind which will stop wasteage and increase revenue. The improvements needed to better the service will come later.

The Lynn system is supplied by the watersheds of four artificial ponds and the Saugus and Ipswich Rivers. The combined catchment area from which water is drawn covers 58 square miles, and the available yield is about 35,000,000 gal. per day, while the present consumption of the city is approximately 8,500,000 gal. per day. Three pumping stations are used on the supply system to pump water from the rivers, or from one pond to another as it passes through them in the process of purification. A fourth pumping station, located in the city, pumps into the mains and the equalizing reservoir and standpipe. Three of the four ponds are in a chain and have a combined storage capacity of a little under four billion gallons. It requires from four to eight months for water to pass from the rivers into the distribution mains. The fourth pond, with a capacity of 350 million gallons, is used as an emergency supply to the distribution mains and can be filled from two of the other ponds.

The distribution system is about 58 per cent. metered and the per capita consumption is slightly over 70 gal. The system is valued at about $5,000,000, with a net bonded indebtedness of approximately $1,000,000. The receipts from the sale of water have varied little from $350,000 per year since 1916, of which from $130,000 to $165,000 yearly has been needed for debt requirements.

Enforcement of Regulations

One of the first things coming to the writer's notice was the fact that the abatements, including adjustments for advance fixture assessments, amounted to about $13,000 per year. A complete reorganization of very lax office methods, and a strict enforcement of the regulations and the shut-off rule have saved $7,000 per year of this amount.

The service pipe in use by the department in 1916 was a type manufactured with a lining, was of high first cost and when used with Lynn water it did not stand up satisfactorily. After some investigation, it was decided that the most economical and serviceable was cement-lined pipe. To prevent the breakage of the lining with ordinary pipe cutters, all pipe was cut in the shop to fit the requirements by the use of a metal cutting machine, which, on a test with a single blade, cut 40 ⅛-in. discs from a piece of 1 in. lined pipe without breaking the cement. To prevent exposed threads in connections, malleable iron countersunk fittings are used, which we line ourselves with lead, leaving only six threads unlined. When this lining comes in contact with the cement lining of the pipe it makes a snug fit without danger of crushing the latter.

The saving effected by the use of this kind of service pipe is in excess of $4,000 per year.

In 1916 the department depended on the use of horses in all its repair work. The motorizing of this work has reduced the number of foremen from five to four, and the number of men on routine repair work about 20 per cent.

Saving Through Testing of Meters

The meter repair shop was not properly equipped to test meters over 1 in. in size and no attempt was made to test and repair meters over 2 in., although 25 per cent. of the revenue from metered water was registered by these large meters. A newly equipped testing plant has been built which includes a calibrated tank of 125 cu. ft. capacity. When the city has been entirely covered and all large meters repaired, indications are that revenue in excess of $5,000 a year will be added.

The Glen Lewis pumping station, which lifts water from Walden Pond to Breeds Pond, was equipped with a motor-driven centrifugal pump when it was built in 1912, but it had no meter for measuring the water pumped, and no tests had been made to ascertain the efficiency of the pumping unit. After complete tests had been made it was discovered that the pump was running at an average overall efficiency of 42 p.c., requiring 90 kw. to pump 14.3 million gallons per day against a 20 ft. head. At a cost of $10,000 this unit has been replaced by a modern centrifugal unit, which delivers 16.4 million gallons against the same head, requires but 60 kw., and operates at 72 p.c. overall efficiency. The saving in operation by this substitution is $3,300 per year, or 33 per cent. of the investment.

The Walden Pond pumping station which pumped water from Hawkes Pond to Walden Pond was built in 1902 and was in operation in 1916, but has now been abandoned. This was a steam station requiring the usual two men per shift to operate it. The water flowed to the suction well of the pump through an open canal about ¾ mile in length, losing about 20 ft. of head in this operation. The water was then pumped through a 30-in. pipe about 1/3 mile long against a total head of 45 ft. Two men on each shift were required to keep the screens clean in the screen house at the end of the canal leading to the suction well, and to operate the gates controlling the supply

No. 21

Canada's Engineers—E. A. Markham

For our "Canada's Engineers" section this week, we have selected, in the person of Mr. E. A. Markham, an engineer who, through his activities in building construction, has contributed a great deal towards the development of the Canadian West. For 9 years he has worked in the Prairie provinces, during which time he has had responsible charge of construction work to the value of over $4,000,000. The work coming under his direction has included buildings and structures of all types and it is safe to say that during the past few years, when war interrupted construction in the West, Mr. Markham has directed most of whatever work there was, in Saskatchewan at any rate.

Mr. Markham graduated in concrete engineering, architecture and building construction, from the Northern Polytechnic Institute of London, England. He then became field engineer for large London contractors until coming to Regina in 1911. From 1912 to 1918 he was superintendent for the Parsons Construction & Engineering Company. He then became general superintendent for the Poole Construction Company and in 1919 was appointed vice-president of the firm. Some of the buildings, the construction of which has been under his direct responsibility, are; Sanitarium Buildings, Fort Qu'Appelle, Sask.; Lands Titles and Court House Buildings, Humboldt, Sask.; Weed Lake Bridge, Broadview, Sask.; Provincial Jail Buildings, Provincial Office Buildings, Normal School, Connaught School, R.N.W.M.P. Barracks, Royal Bank Building, foundation work of the Hotel Qu'Appelle, Milestone Reservoir, Sawyer-Massey warehouse, Dominion Rubber System's warehouse, Whitmore warehouses, Northern Electric warehouse, all of Regina. At the present time the firm is constructing among other buildings a Saskatchewan Co-operative Creamery building at Regina and one at Melville, and the Wood-Vallance warehouse, Regina.

Mr. Markham was elected an Associate Member of the Engineering Institute of Canada in June, 1918.

Mr. E. A. Markham

He takes a great interest in association affairs and represented his company at the conference of the Association of Canadian Building & Construction Industries at Ottawa last February.

of water to the canal, making in all 12 men in 24 hours for the running of the station.

Efficient Pumping

The writer has designed a new station to do this work which is so situated that the total length of 36 in. discharge pipe is 540 ft. and the suction is direct from Hawkes Pond. The station is equipped with a motor-driven centrifugal unit, pumping 20,000,000 gal. per day against a 23-ft. head with an overall efficiency of 74 per cent. This unit is so protected by safety devices that the only attendance required is that given by the regular patrolman on the pond. This change has effected a reduction in labor from 12 men per day to none, a reduction in head pumped against from 45 ft. to 23 ft., a reduction in the cost of pumping from $5.45 to $1.75 per million gallons, and nets a yearly saving of $9,600 in the cost of operation, and required a net investment of but $35,000.

Until recently, the city of Lynn has been compelled to furnish water to the adjoining town of Saugus on the basis that the city should furnish water, make inspections, read meters and collect the water charges. The town was to maintain its distribution system, for which it was refunded 50 per cent. of the receipts. Since the city of Lynn furnished all of the water, any wastage in the town system would yield greater returns to the latter.

The proper remedy was to meter the entire town supply, but the determination of an equitable rate was a very difficult proceeding. A thorough investigation including a valuation of the town supply system resulted in a charge of 5.1 ct. per cubic foot for water sold to the town.

In addition to giving up all work included under the old contract, the city of Lynn will receive over $4,000 more annually for this business than formerly.

Elimination of friction losses on the suction of the pumps in the main pumping station will eventually result in a saving of over $6,000 per year.

These improvements have resulted in a saving and added revenue in excess of what would have been obtained by a 12 per cent. increase in rates and have enabled the city to meet the necessary advances in prices.

New Water Supply for Grand'Mere

Grand'Mere is to have a new water supply, the plans for which are being prepared by Messrs. R. S. & W. S. Lea, of Montreal. The water will be supplied from the Lake des Piles. The town of Shawinigan suggested that a joint scheme be carried out, but this has not been accepted. It will be necessary to obtain the authority of the provincial government before the Grand'Mere scheme can be carried into effect.

Mechanical Loaders Handle Gravel at Low Cost

Experience in British Columbia Proves Hand Methods Extravagant and Slow — Comparison of Costs

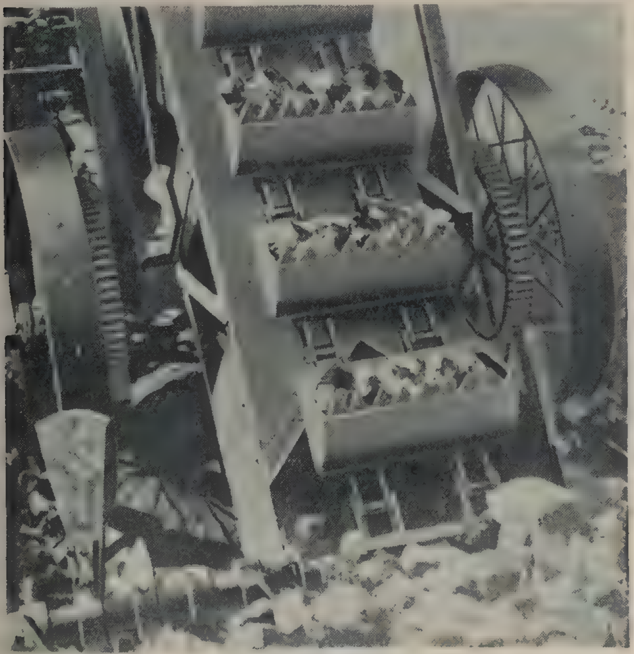
By P. Philip*

IN discussing the subject of mechanical and other loaders with reference to work carried out in British Columbia during the past season I propose to describe four types of loaders:

1. "Haiss" mechanical loader—motive power gasoline.
2. Clamshell—steam power.
3. Team and scraper.
4. Loading by hand shovelling.

Mechanical Loader

1. The "Haiss" mechanical loader was introduced to Delta district this past summer and has been in continuous operation up to the present time. This machine has given results which have more than justified its introduction. Designed for a capacity of 480 to 500 cubic yards per 8-hour day, working under the most favorable conditions, this machine may be considered as capable of loading from 160 to 350 cubic yards per day, when working in gravel pits.


A gasoline-operated bucket loader

There are factors to be considered, such as cleaning the overburden of dirt, stopping due to delays in trucks and teams, starting up in cold mornings, etc.

With a few exceptions the pits in Delta district are not ideally situated for loading gravel, having shallow faces. It is in these pits that the loader has the great advantage over any other type. The machine has reduced the cost of loading gravel by at least 50 per cent., for it will easily load 160 cubic yards per day at a cost of 12.3 cents per cubic yard and under more favorable conditions has loaded for 6.6 cents per cubic yard.

Where the gravel is to be hauled a long distance it is absolutely essential that the loader be kept in constant operation either by having portable bunkers in conjunction with same or by increasing the number of trucks. By a skillful combination of truck and loader the problem of gravelling the roads in record time (and at the critical time) is solved.

The advantage of the loader is that it is self-propelling, simple to operate, requires only an intelligent skilled laborer to run same. The crew consists of three men, one to operate the machine (this man is paid 50c per hour more than the ordinary laborer), two men stripping the face of pit, loosening the gravel, cleaning away roots and debris. With the above crew the loader can be fed to its full capacity. If the pit has a high face one man can be dispensed with.

The machine cannot dig cemented gravel. The material must be loosened ready for the buckets, so that he who expects the loader to be a small steam shovel will be disappointed.

Although the loader has been in constant operation no accidents have occurred to it. Consequently we have had no heavy bill for its repair.

The following are the details of the mechanical loader:

Seven and a half h. p. gasoline engine; wheels, 24 in. diameter in front, 48 in. in rear; 6 in. tread; wheel base 70 in., buckets, carbon steel, 18 in. x 12 in., one half cu. ft. capacity. Self propelling forward and reverse 1 mile per hr. forward. Chute adjustable from 7½ to 8¼ feet above ground. Cost $2,650 f.o.b. Vancouver.

Wherever men are used to any great extent for loading gravel, get a mechanical loader and eliminate slavery of the worst type.

Mechanical loader filling motor truck

2. **Clamshell.** A clamshell was used on Nicomen slough for loading rock tailings into scows. This type has been in common use and needs no explanation. Cost of loading 3000 cubic yards of material was 6 cents per cubic yard; 2000 cubic yards cost 16 cents

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*District engineer, B. C. Department of Public Works; before convention of Provincial District Engineers.

Loading motor trucks with gravel from bunker through gate-operated chutes

per yard to load on account of an insufficiency of scows.

The capacity of buckets is 7/8 cubic yards and the daily capacity is 300 cubic yards. The daily cost of operation is:

Engineer, fireman and helper	$15.00
Fuel, oil, upkeep, depreciation	5.50
	$20.50
Cost per cubic yard	6.8c

3. **Loading by team and scraper from side hill pit to bunker.** Where the material is suitable for scraper work this method compares favorably with the mechanical loader. The cost of loading 90 cubic yards of fine rock with team and scraper was 14 cents per cubic yard. It must be considered whether the amount of material available will justify the expense of erecting bunkers.

4. **Hand shovelling.** A man will shovel loose gravel at the rate of 15 cubic yards per day. The cost is 27 cents per cubic yard. There is no need to enter into details of this particular class of work, distasteful and strenuous. The foregoing remarks on the mechanical loader shows conclusively that hand shovelling is the most extravagant method of loading. We no longer use the flail to thresh, then why use a hand shovel to load?

The following tabulation shows costs for loading truck, assuming the truck makes 8 trips per day with a load of 2 cubic yards, taking into consideration the cost due to delay in loading:

Loading by Hand—16 Cubic Yards

3 men for 2.8 hours	$4.20
2.8 hours delay of auto truck at $30 per day	10.50
Total cost	$14.70

Mecahnical Loader—16 Cubic Yards

16 cubic yards at 12.3 cents	$1.97
4/5 hours delay of truck	3.00
Total cost	$4.97

The above figures which are a fair comparison show the urgent necessity for the introduction of more modern methods of loading.

Notice

H. L. Symons & Co., engineers and contractors, have recently opened offices at 43 Scott St., Toronto. They will be very pleased to receive catalogues and price lists from supply firms.

St. Margaret's Bay Power Development

Nova Scotia Power Commisson Awards Contract — Stations to be Completed in January and June, 1921

THE Nova Scotia Power Commission met in Halifax on April 15th to consider tenders for general construction work, hydraulic and electrical equipment for the St. Margaret's Bay power development. Very satisfactory tenders were received for all work on which tenders were called, there being a particularly large number of good tenders for the general construction.

It was decided to award the contract for the electrical generators, four in all, to the Canadian General Electric Company and these machines will be manufactured in this company's shops at Peterboro, Ont. The contract for a quantity of wood-stave pipe 6 feet and 10 feet in diameter was awarded to the Pacific Coast Pipe Company of Vancouver. About 200,000 lbs. of aluminum cable for transmission line purposes is to be supplied by the Northern Aluminum Company who manufacture at Shawinigan Falls, Que. It was decided to award the contract for the general construction work, this work involving the building of dams, power-houses and intakes, the grading of pipe lines and other miscellaneous work, to Messrs. D. G. Loomis & Sons, general contractors, of Montreal. A number of attractive proposals for this work were received. Due to the fact that certain essential data had not yet been received from hydraulic manufacturers, a final award for the water-wheels could not be made although a tentative conclusion was reached.

The specifications for this work call for the completion of one generating station by January 1st, 1921, and the completion of the second generating station by June 1st, 1921. The total development at present under way is designed to deliver about 9,000 h. p. in Halifax.

Saguenay Development Postponed

It is reported that the plans made my Price Brothers and Company, Limited, for the construction of mills and a model town on the Saguenay River, four miles from Chicoutimi, P.Q., have been suspended, as the machinery for the mill cannot be delivered before next year. The estimated cost of the project is twenty million dollars.

Concrete Trim and Building Ornaments

Author Describes His Experiences in Developing the Use of Concrete as a Decorative Medium

By R. Schilling*

FIFTEEN years ago, when I started to make concrete attractive and pleasing to the eye, I accepted as definitely settled concrete's claim for strength and endurance, demonstrated by the engineers in their work of that time and by the examples of ancient concrete work still in existence, some of it dating back 2,000 years. My researches and experiments have been devoted entirely to giving concrete the attractive and artistic qualities which would make it interesting to the architect and decorator as a medium for embellishment and actual construction in their work.

Twenty years of practical experience among the natural stones used in monumental and building work, enabled me to realize the conditions that must be met, to give concrete a place alongside limestones, marbles, granites and clay products in which the architects had expressed their thoughts almost exclusively. In the making of concrete, after once thoroughly understanding the qualities of cement as a binder or matrix, one can learn to adopt many mineral and metal resources as readily as we employ the better known sand, gravel and crushed stone for aggregates.

Building Trim

After proving to my own satisfaction that cast stone could be made successfully, it required considerable missionary work to convince the architect of its merits and advantages for his building construction and enrichment of design, so far claimed by terra cotta, natural stones, faience, etc. The many examples of cast stone executed during recent years give ample proof that the confidence of the early pioneers in the possibilities of high grade concrete products was well founded.

To cover the methods of manufacture in detail would exceed the limit of this report. We have successfully used plaster, glue, wood, sand, cement and steel molds. A kind of mold extensively used in our plant is made of channel irons, in sizes from 2 inches to 18 inches wide, and in lengths from 4 to 8 feet. If set on level tables or benches, the main part of a mold that offers great flexibility in its use is provided; the channel irons are held together by different length rods at the ends; wood or plaster inserts, plain or molded determine the width, length and design of the unit to be cast. The work is poured with finished face down and can be solid or hollow, surfaced with special material on any one side or all four sides, if the volume of the stone makes it more economical to use a core of less valuable aggregates.

Some excellent work has been done modeling directly with cement mortar by artists who have attained their efficiency in this method abroad. The artist builds up his design with permanent skeleton frame work, similar to modeling in clay. Around the skeleton he forms a rough outline of his design in wire cloth or expanded metal and on this is placed a scratch coat of cement mortar with which when set, he begins to model the final outline of his design. The artist is enabled, by using mixtures of quick setting and slow setting cement mortars, to regulate his medium. In this way he can give the work the same freedom and spirit as if he modeled in clay, producing any texture desired; color effects can be obtained at random, by using colored cement of various shades, for instance, a garland of flowers can be modeled in their natural colors.

The Treating of Surfaces

We use electric rubbing wheels for smooth finish, acid for grain texture finish, and all the tools used in the natural stone trade for tooled finishes, according to the effect desired in the cast stone; and one, or all treatments may be used on one piece. We have transportable rubbing and tooling machines to surface the extra heavy castings, and stationary machines for the smaller units. A cutting plant for natural stone is an ideal foundation to start an up-to-date cast stone business, even to the use of its rubbing beds and gang saws.

I find that concrete of proper age can be treated just like any natural stone, using the same tools and machinery to dress its surfaces, or saw big cast blocks into slabs and strips. It is my strong conviction that the success of concrete stone for building purposes, rests in a close affiliation of the stone caster and the stone cutter. Only in this way will we be able to give concrete proper texture and the necessary qualities of dimension stone, so essential to the architect and builder for durable and attractive construction.

Importance of a Stone Cutter

The addition to every concrete products plant, of a skilled stone cutter would be a source of profit and also result in better work. The stone cutter is trained to have dimension stone true to size and shape. The average worker in cement or concrete does not appreciate this essential point, but it is all important with the architect and general contractor. The services of a stone cutter will enable the concrete manufacturer to set his own work, which is very desirable for the best final results. We found the brick or natural stone mason does not give composition stone the required care when setting it, for reasons of trade jealousy, but once give this fraternity to understand that concrete stone means extensive employment to stone cutters and setters, their antagonism will vanish as they realize their own benefit in the broader use of cast stone. Whenever the opportunity presents itself, I strongly recommend closer affiliation of the composite and natural stone trades. The enormous increase in all building operations of whatever class, and the constant effort for betterment in the moderate priced house gives abundant field for both trades in higher class of work and at more satisfactory profits.

Acid Treatment

To the manufacturer or worker of concrete products, I further recommend the adoption of such methods as are employed successfully in other lines of manufacture in treating the surfaces of their products. In many cases instead of applying the paint by brush, the article is immersed in the paint. This method can be adapted to acid washing of the concrete products, to remove the surface film and expose the aggregates. Tanks of sufficient size are not a hard matter to construct in the concrete shop, and the immersion of concrete products in acid will not only prove a great saving of acid and labor, but produce a class of work that cannot be obtained with the scrubbing brush. We have two rectangular tanks 4 ft. by 4 ft. by 16 ft. built of cement slabs, grooved and bolted together, and six circular wood tanks 7 ft. diameter, from 2 to 4 ft. deep. Concrete should be from 2 to 3 weeks old before treating in acid bath; duration of bath depends on age of the stone and if rough or fine texture is desired the time being from 1 to 10 hours. A weak solution from 1 to 10 up to 1 to 20 is required and after the article is put in the tank, the solution does the rest. This style treatment preserves the edges and details of the design, and makes the surface uniform. Any of the hard spots not sufficiently affected by the acid bath, can be treated separately after the article has been flushed with clean water. Care must be taken that the aggregates of the surface are nearly uniform in hardness, or the acid will eat the soft portion out before the harder particles have been cleaned of the cement coating.

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*Before Conference on Concrete House Construction.

Colored Concrete

To produce color effects, we may use gray or white portland cements, either by themselves, or mixed in certain proportions, adding to this, suitable pigments, but in many cases, the natural colored aggregates, sand, silica, pebble grit, marble and granite, will give excellent and more uniform results. It requires great skill and care to properly mix cement and color pigments without reducing the strength of the cement, and still obtain uniform color effects.

As a very simple method to test the proper amalgamation of the pigment with the cement, take a handful of the dry mixture, and press it under a sheet of stiff paper, this will produce an even surface of the material, and as long as this surface does not show absolute uniformity in color, the mixing is incomplete. If small specks of color show on the surface under this test, these same specks of unassimilated pigment will appear in the concrete. So far a very important factor that can be utilized for coloring concrete or cement, has been given little or no attention while very simple in its primary action, the successful application requires thorough understanding of the principle and medium employed.

Coloring by Capillary Action

The absorptive qualities of concrete during its stage of curing and seasoning offer opportunities for coloring concrete products by capillary action. By this method, the color is deposited into the pores of the surface, amalgamating with the concrete into a permanent unit. The possibilities of this treatment are unlimited, based on knowledge of coloring values and good judgment not to impair the strength requirements of concrete. Coloring solution can be made to penetrate the surface of concrete, six inches or more, if the object is immersed while in a very green state, but it is rarely necessary to penetrate more than 1/32 to 1/8 of an inch; this thoroughly fills all pores, gives the desired color effects and is less expensive. Every atom of coloring absorbed by the concrete reduces the strength of the solution; and as some of the coloring matter used is quite expensive, good judgment in allowing only the necessary absorption of coloring matter would be advisable from an economic standpoint. The sulphates of copper and iron are the most suitable to make solutions to color concrete by the capillary method.

The concrete to be colored can be treated after it is a week old. Concrete products used in construction and carrying loads should not be subjected to the coloring bath until the concrete has attained its required strength; as the filling of the pores in the concrete retards the action of curing by the usual methods. Coloring by absorption is effective on surfaces of concrete after it comes out of the mold, or after being treated with tools. Surfaces that have been colored by absorbing mineral or metallic colors become more weatherproof and the action of the weather on the metallic colors is the same as on real metals, increasing the beauty of coloring by the usual oxidation noticed on bronze and copper. The surfaces of concrete treated by this method, become so hard and dense that they will take a polish. I have treated such surfaces in the same manner as marble, granite and metal under polishing or buffing machines.

Wet Cast Products

Our products made by wet cast methods, such as flower pots, vases and boxes, will hold water after the second day of casting and become so hard that when struck with a hammer, they ring like a metal bell; waterproofing compound helps, but is not essential to obtain this result. I consider that the thorough mixing of the proper amount of cement and water with graded aggregates is all important. Extensive tests made during the past three years with commercial waterproof paints produced excellent results. Common concrete can be made very attractive by one or two coats and, applied in stipple fashion, it will not impair the grain or texture, avoiding the undesirable effect of painted stone. This method is especially to be recommended for dry or semi-dry tamped concrete work, as the porous surface readily absorbs the waterproof liquid, and allows the pigment particles to fill the pores.

The color effect obtained in this manner is the most economical. It is a uniform color but does not give the richness and depth of shading that results by the immersion treatment in a metallic color bath. It has the advantage, however, of being applied where immersion is not practicable. I have obtained two and three color effects, by painting certain parts of an object, before subjecting same to the coloring bath; the parts so colored would not be affected by the color in the bath.

The artistic possibilities of such treatment are only limited by the color sense and taste of the craftsman. Using certain non-absorptive aggregates, their natural color can be retained, while the absorptive parts, especially the cement mortar, will assume the desired color. In this treatment precaution must be taken in the use of acids in washing before immersion in the color bath as the chemical action of the acids is liable to counteract the color values of the bath. Acid should not be employed on concrete treated with colors.

Curing

Most of our trim stone and ornamental work is wet cast, it is required to stay in the mold from 24 to 48 hours, and we use a 4 per cent. solution of calcium chloride for our mixing water. During cold weather our shops are steam heated and kept at a temperature of 70 degrees. We have no curing rooms but for quick curing use high pressure steam cylinders 6 ft. in diameter and 70 ft. long.

While these tests did not exceed 80 pounds pressure, we have hardened concrete up to 150 pounds pressure with the result that concrete 2 days old, could be tooled under rapid speeding carborundum wheels, cutting flint aggregate without pulling out or fraying the edges. The mixtures used were from 1 to 10. Compression tests showed over 4,000 pounds in two days and absorption less than 5 per cent. The higher the steam pressure the less time it requires to harden. With 150 pounds we reduced the time to 4 hours, besides the two to three hours it requires to bring the pressure up to 150 pounds.

No portland cement concrete product should be subjected to high pressure steam curing until it has its initial set. The steam cure should start preferably the day following the casting.

Tamped concrete should be kept moist until it goes into the cylinder. As the initial expense of equipment and operating is considerably higher than curing rooms, only units that lend themselves to completely filling the cylinder space, can be hardened economically, like brick, tile or blocks; at present prices it costs about $20.00 to harden a volume equal to 900 cubic feet or 20,000 brick. The cost of a cylinder of above size is $6,000 installed. They should be used in pairs to allow the utilizing of steam blow off, from one cylinder to the other, after the curing is finished.

First Grain Elevator at Three Rivers, P. Q.

Reinforced Concrete and Wood Frame Structure—Details of Design—Quantity and Cost of Concrete

By Romeo Morrissette, C.E., A.M.E.I.C.

THE first grain elevator at Three Rivers, Que., has just been completed near the Bureau Wharf. It is a private enterprise for Mr. L. N. Jourdain, grain dealer, Three Rivers, the plans being prepared by Mr. Jules Caron, architect, 69 St. Francois Xavier Street, Three Rivers, with Messrs. Bauline & Leonard of Montreal as consulting engineers. The work was carried on by day labor, under the direction of Mr. F. X. Gravel, contractor, Three Rivers.

The first grain elevator at Three Rivers, P.Q.

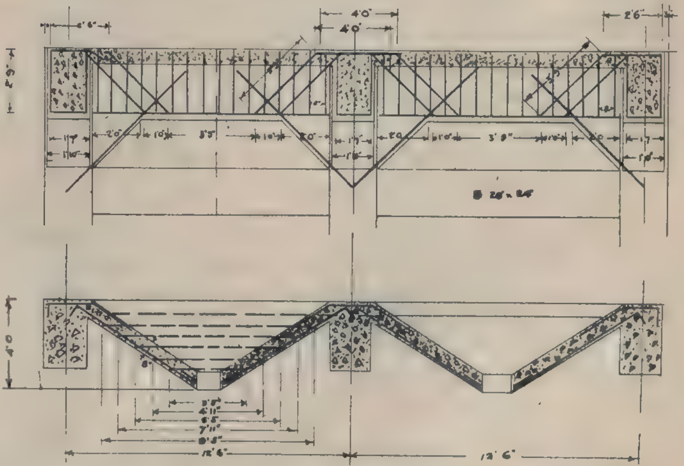
The building comprises a concrete foundation, reinforced concrete sub-structure for the first storey, and frame work for the second floor and the bins. The exterior walls of the main portion of the building are wainscotted with plastic brick. The whole building will cost, when completed, $35,000. The work was started during August 1919.

The building includes two sections, a main storage building to be used as grain warehouse, and a bin section. The dimensions are 85 ft. x 50 ft. at the concrete foundation. The warehouse is 52 ft. long, and the bin base is 33 ft., the whole wainscotted with bricks. The first storey is of reinforced concrete, the specified mixture being 1:2:4. The columns in the former section are 18 in. x 18 in. in section, and are spaced 12 ft. 9 in. centre to centre lengthwise, and 12 ft. centre to centre, crosswise. They are reinforced with four 1-inch bars, spaced 8 inches apart, and six 5/16-in. bars, spaced at 5.6-in. In the bin section, the columns are 24 in. x 24 in.; reinforced with four 1¼-in. bars, spaced 6.6-in. centre to centre, and four 5/16-in. bars, spaced 7,6-in. c. to c. The concrete girders and beams are reinforced with from 14 to 21 ⅜-in. stirrups spaced 5 ft. c. to c. A reinforced concrete 8-in. slab has been built, reinforced with ⅝-in. bars, spaced from 3 ft. 6 in. to 10 in., c. to c.

Cost Data

The quantity of concrete used for the warehouse is summarized as follows:

In the foundation, piers and columns, 8766 cubic feet or 324.68 cubic yards of reinforced concrete, at $9.00 .. ..$2,922.12



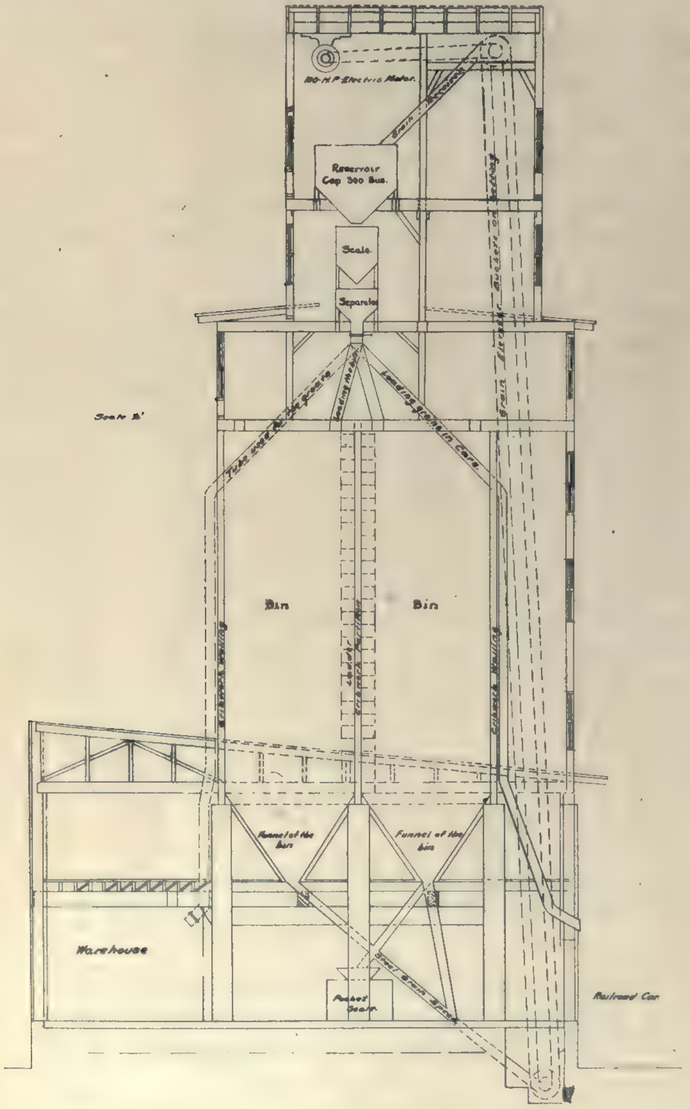
Details of the reinforced concrete floor of the grain bins

Concrete floor and beam slabs, 145.12 cubic yards, at $9.00 .. ..$1,306.08

In the bins the following concrete was used:

14 concrete blocks 2 ft. x 2 ft. x 2 ft.	112 cu. ft.
4 additional beams 27 ft. x 2 ft. x 3 ft. ..	648 cu. ft.
3 additional beams 33½ x 2 ft. x 3 ft. ..	603 cu. ft.
6 concrete funnels 105 ft. x 66 in.	416 cu. ft.
12 columns	240 cu. ft.
Slabs	31 cu ft.
Total	2050 cu. ft.
or 76 cubic yards at $9.00	$684.00

This work was carried on by Mr. N. Beaudry, contractor in concrete works, Three Rivers, at a unit price of $9.00, but the owner had to pay depreciation on machines which cost $1076 in addition to the unit cost of concrete. The total quantity of brick placed in this building was 94,800 common bricks, and 47,500 plastic bricks. The approximate cost was $31.00 per thousand laid up. The brick work was carried on by Mr. W. Durocher, brick mason, Three Rivers.



Section through bins, showing operating machinery

The elevated section included six bins 6 ft. by 12 ft. in plan, and 62 ft. high, built in cribwork, consisting of 3 inch by 6 inch spruce plank, laid up flat. The bins are to be covered outside with a concrete stucco. As shown on one sketch herewith, all the machinery is electrically operated and includes one 45 h.p. motor and one 100 h.p. motor. The grain is discharged from railroad cars coming alongside the building, and is raised by an 8-in. belt bucket elevator, with a capacity of three tons. The elevator is equipped with one automatic balance scale measuring 1800 lbs. per hour, one pocket balance which is shown on the ground floor, one dust fan, one grain crusher, and one grain separator. When reaching the top of the elevator, the grain is conveyed to the different bins by steel grain speeds. These machines have been supplied by the Canadian Fairbanks-Morse Co., Ltd., Montreal, and the Otis-Fensom Elevator Co., Ltd., Toronto.

Montreal Wants $3,000,000 for Housing

Montreal will apply to the Quebec government for $3,000,000 for workmen's houses, and the necessary by-law has been submitted to the council. Mr. Oscar Morin, provincial director of housing, however, has intimated that the following amounts have been apportioned to the undermentioned municipalities, and that the amount will come out of the $3,000,000 loan to Montreal: St. Lambert, $200,000; Montreal South, $30,000; Greenfield Park, $30,000; Longueuil, $50,000; Montreal East, $100,000; Point aux Trembles, $100,000; Lachine, $100,000; Verdun, $250,000; and Mount Royal, $200,000; making a total of $1,060,000.

Dinner of Quebec Builders' Exchange

The first annual dinner of the Quebec Builders' Exchange, held at the Chateau Frontenac on April 12th, was a great success. About two hundred people were present. After the meal was over, speeches were made by several well-known people, among them being His Worship Mayor Samson, Messrs. E. Lapointe, M.P., Hon. Ant. Galipault, Eug. Julien, and the President of the Association, Mr. E. G. Brousseau. The latter delivered the main speech of the evening, an interesting address on "Construction," which was appreciated by the large attendance present. A large number of prominent builders from Montreal and other cities were present at the event.

A Chance for Canadian Cement in Australia

Builders and sewerage boards in Australia, despite the development of production within the Commonwealth, are faced with a serious shortage of cement, and unless supplies are soon made available work upon large works of varied character will be compelled to cease for want of this commodity. Cabled quotations from Canada, combined with the freight rates, were not competitive, according to a recent Trade and Commerce Report. This is to be regretted for the reason that the demand formed an excellent opportunity for demonstrating that Canadian cement is equal in quality to the well-known (prior to the war) British and Continental brands.

The Administrative Commission of Montreal has appointed Messrs. R. S. Lea, and Walter J. Francis, consulting engineers, together with City Engineer Doucet as a board of supervising engineers on the new aqueduct. Each consulting engineer will be paid a salary of $10,000 a year, for which they will give two-thirds of their time to the city, or 200 days a year.

Bituminous Roads in British Columbia

Paper Read Before Provincial District Engineers Analyzes Results of Oil, Asphalt and Tar Construction

By W. P. Beavan*

THE preparation of a paper concerning the subject of bituminous roads is a matter in which it is almost impossible to avoid what may appear to be direct plagiarism, the subject having been so thoroughly investigated and written of by many of the leading authorities on highway construction and chemical engineering. However, for the purpose of this convention, the writer has been asked to prepare a paper dealing with the subject of oiled roads and bituminous road construction, particularly with the bituminous work done in British Columbia during the past season. Before presenting a resume of the work done or discussing the various materials and methods used, it will perhaps be of interest and will prepare the way for a better appreciation of the subject, if something in the way of an analysis is made of the relation which present day traffic conditions bear to the construction and maintenance values of bituminous materials such as are used in the oiling of roads and the construction of bituminous surface.

By "present day traffic conditions," is meant, the passage over the roads of heavy, fast moving motor vehicles. This explanation it is necessary to specially bear in mind when considering the values of bituminous materials for use in this province, where, in some districts, horse traffic still does and will continue to form an appreciable quantity of the traffic over the roads. Though motor traffic imposes a greater stress upon the roads than horse traffic, yet it will be found that horse traffic may seriously damage a road surface quite suitable for motor traffic. It is not that the destructive force of traffic has changed, but that the motor traffic has intensified the extent of the destructive force and, in an endeavor to provide against the damage done by motor traffic, work may be done which is not suitable for mixed traffic. The wearing stress imposed on a road by traffic, and of course by climatic conditions, may be divided as follows, each division acting in a different way upon the surface and body of the road, and all having a deleterious effect. (Except in the case of certain types of bituminous surfaced roads, where one or more of the divisions of the stress, in a way, are of benefit, this being considered later.) The divisions are: 1, dead and live load; 2, impact; 3, suction; 4, shear; 5, climate.

A brief explanatory detailing of these, relative to road surface is:

Dead and live load.—The force produced and exerted on the road by the weight of standing or moving traffic tendng to cause compression of the surface, crushing of the material forming the surface, displacement of the surface, the base, and the subsoil.

Impact.—The blow given by moving wheels, or horses' hoofs, producing disintegration of the road surface.

Suction.—The partial vacuum, the effect of wheel tires and body of a fast moving vehicle, lifting and removing the finer particles of the material of the road surface.

Shear.—This is really a combination of "load" and "impact" producing a scraping effect on the road surface, tearing and displacing.

Climate.—Expansion, contraction, softening, erosion by water and wind.

With these causes of the deterioration of a road surface so tabulated, comparison can be made of the various types of bituminous construction, and protection of road surface.

The term "bituminous material" is intended to include oils, asphalts, and tar products. In order to obtain some estimate of the relative values of these in the work of constructing and preserving roads, they will be considered, point by point, through each of the wearing stresses previously mentioned. For this purpose, it is taken for granted throughout the comparisons, that the base or surface respectfully for construction preservation is in first class condition, that is, good subsoil or base, good drainage, with reasonable contour and grade.

DEAD AND LIVE LOAD

Oil	Asphalt	Tar
Oiling a surface adds nothing to its carrying strength or rigidity and does not prevent, lessen or distribute crushing stress.	As a flush coat, same lack of value as oil. In construction by mixing, provides rigid surface capable of bearing great pressure. Pressure evenly distributed through the surface to the base, and subsoil. In constructing by penetration, similar to, though slightly less value than by mixing.	As a flush coat, same as oil. Construction by mixing and penetration similar though less reliable than asphalt. Tar does not solidify or set at even low temperatures. Tar products though "stiffer" than tar retain something of this characteristic.

"IMPACT"

Oil	Asphalt	Tar
An oiled surface is little or no protection against impact, especially of horse traffic.	As a flush coat, same as oil, though the damage done by impact would be less serious than on oil, as abrasions of the surface would heal in fine weather. In construction by mixing, affords the maximum resistance to impact possible with a paved surface, absorbing shock without disintegrative effect. Construction by penetration, less value than by mixing.	As a flush coast, same as oil. Construction, mixing or penetration, same value as asphalt.

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*Assistant District Engineer, British Columbia Department of Public Works.

"SUCTION"

Oil	Asphalt	Tar
An oiled surface using suitable heavy oil, is of great value.	As a flush coat, same value as oil. Construction by mixing and penetration, complete protection against suction.	As a flush coat and for construction complete protection against suction.

"SHEAR"

Oil	Asphalt	Tar
An oiled surface affords partial protection against shear, value being least at high temperatures.	As a flush coat, superior to oil, being less affected by temperature. In construction, mixing and penetration, this affords still better protection; this by reason of its use in the mass of the surface material.	As a flush coat or in construction less value than asphalt, due to its greater ductility, offering less resistance to scraping, and tearing.

"CLIMATE"

Oil	Asphalt	Tar
An oiled surface, using good oil, under favorable weather conditions can be kept in a good state of repair at little expense, but with moisture alternate freezing and thawing, will rapidly break up, particularly under horse traffic.	As a flush coat, superior somewhat to oil, yet will break up quite as readily under horse traffic. In construction by mixing methods, a well balanced grading of the aggregate, combined with the correct amount of asphaltic cement will form a surface impervious to moisture, and proof against the action of extremes of temperature. By penetration method, slightly less reliable.	As a flush coat similar to oil. In construction by both methods, less value than asphalt being far more susceptible to the action of moisture than is asphalt. Nor, at high temperatures does it retain its rigidity to the same extent as asphalt; at summer temperature it is always possible to make a complete "penetration" of the surface of "tar construction" paving surfaces. This would be impossible with asphalt.

Oil Affords Little Protection

Summarizing these values, we find that the chief value of oil is in its prevention of the loosening and removal of the finer particles (dust) that are so valuable in forming the bond of the materials contained in the road surface. It has no value against crushing, shearing, or impact stress, and is not proof against adverse climate conditions. From this it will be seen that its use is confined to a surface flush coating application, which, of course, penetrates the road surface to a greater or less degree, this varying with the quality of the oil, the manner in which it is applied, the grade of the materials in the road surface and local weather conditions during and after application. Whatever the degree of penetration, however, it possesses little value in resistance of traffic stress, although it is some protection against surface moisture during fair weather, but none at low temperatures.

The use of oil is, primarily, to eliminate the "dust nuisance" in cities, and to afford some measures of resistance to the abrasive action, and attrition caused by the suction of motor tires. The relief afforded is temporary only, it being found necessary often to make more than one application of oil during a season, while repairs, with a fresh application are imperative after each winter. The chief advantage of the use of oil appears to be that it can be easily and inexpensively applied, affording temporary relief in lieu of more expensive surfacings.

The Value of Asphalt

The use of asphalt, as a flush coat on gravel or macadam road surfaces has practically the same value as oil, that is, on roads carrying any horse traffic, though on a road used solely by motor traffic it would give complete protection to the road surface, and would be proof against even very severe climatic conditions. In construction, by the mixing method, of any of the various types of paving in which it is used, asphalt has a very high value, its proper use giving full protection against the action of moisture, and great extremes in temperature. It forms a rigid road surface capable of carrying heavy loads, and offers great resistance to the wearing action of traffic.

In construction by the "penetration" method, almost equally as satisfactory results are obtainable with asphalt, the only disadvantage to its use in this manner being that it is not possible to secure the same even and accurate grading of the mineral aggregate, nor to as thoroughly coat every particle of it, as is the case when the mixing method is employed. This results in a somewhat variable surface, that is, variable in texture, which naturally means that the surface will not present an even resistance to the wear and tear of traffic or the action of the elements. As a chain, so is a pavement, no stronger than its weakest point. However, very excellent, and, very economical work has been done, and after all, the maintenance of such pavings is easy and inexpensive. The penetration method offers a solution of the road problem for small municipalities and for districts where it is not possible to purchase or operate the equipment necessary in the mixing method, the chief essential to successful work being a thorough knowledge of the properties of the materials used, and an intelligent control of the work.

Adaptable to Wide Range of Circumstances

In general, concerning asphalts or asphaltic cements, which is perhaps the more-correct term to use, they possess what may be termed a "wide margin of safety" and have an advantage possessed by no other paving material, that of being adaptable to a very wide range of circumstances and situations, and further, can be used in the mixing method at times when it would be impossible to use, or proceed with work with any other type of paving, or road surface material. Asphaltic construction can be carried on in almost any climatic condition, short of actually placing the mixture in water; its use is not adversely affected by extreme heat or by frost—the writer has placed sheet asphalt paving in a temperature at 10 below after having cleared snow from the base. Delay in the work due to breakdowns or interruption does not cause damage to the work done, nor preclude fully successful continuation, no matter for how long the interval. It is also possible to pave a surface without shutting the road to traffic; while this is not good practice, being an annoyance to the working of the crew, it can and has been often done to avoid subjecting traffic to wide detours.

The use of tar, or any tar product, as a flush coating for gravel and macadam roads, and in construction by both the mixing and the penetration methods, is, broadly speaking, similar in detail to the use of asphalt, although its value is, owing to its lack of stability, considerably less than that of asphalt. Tar pavings do not possess the solidity and resistive power of pavings in which asphaltic cement is used, while tar, with age, becomes brittle, thus further tending to shorten the life of surfaces in which it is used. During the past season, a large yardage of oiling and bituminous road work has been done at various points in the province, some of which was done by the Provincial Public Works Department. A statement of this work, in so far as it has come under the writer's observation or control, will perhaps be of interest and is as follows:

OILED ROAD WORK

City of Victoria

527,749 square yards—work done by day labor.

Labor, etc.	$2099.12
Oil	4423.30
Sand	1813.50
Total	$8335.92
Cost per square yard	$0.01579

City of Vancouver

261,145 square yards—work done by day labor.

Labor, etc.	$1206.80
Oil	3770.61
Sand	681.20
Total	$5658.61
Cost per square yard	$0.021668

City of Port Moody

11,730 square yards—work done by day labor.

Labor	$ 581.39
Oil	623.52
Stone	514.50
Hire of equipment	80.00
Total	$1799.41
Cost per square yard	$0.1534

City of Penticton

Work done by day labor.

Approximately 3,333 sq. yds. of the main street were oiled; oil was applied hot, under pressure, to the road which had been scarified, gravelled, and well rolled; the oil was a 15 Beaume which, for the work, was light. The road did not consolidate, and later was treated with a coating of asphaltic cement.

ASPHALTIC FLUSH COAT

City of Penticton

3,333 sq. yds., work done by day labor; total cost, $1,614.55; cost per sq. yd., $0.48.

The following extract from a report on the work is self explanatory: "Am sorry to tell you that the street is not standing up well; it is getting "patchy." This is owing to rough shod horses going over it, which cut it up badly; cars and trucks do not cut it up."

"TARVIA" FLUSH COAT

D. L. 172 Burnaby

Flush coat spread by contract; approx. 3,400 sq. yds. The cost of "Tarvia" flush coat alone, not including screenings was 5 1/3c per sq. yd.

This road was prepared by placing and rolling approx. 7 in. of gravel. Fair consolidation was made before the flush coat of tarvia was applied. The work was done in damp weather with poor results. The cost of "Tarvia B" was 16c per gallon spread on the road; 1/3 gallon per sq. yd. was used.

"TARVIA" FLUSH COAT AND PENETRATION COMBINED

Marine Drive, South Vancouver

10,000 square yards, done by contract. All holes and ruts in the road filled with fine, clean crushed rock and poured with Tarvia "X". The entire surface of the road was first thoroughly cleaned off by means of water hosing. After the holes were filled, an application of 0.6 gallons per sq. yd. of Tarvia "A" was spread covered with a layer of Torpedo gravel and then well rolled. This work was very successful in improving what had previously been an almost impassable road. At latest report, the surface is standing well, though it is quite soft under the heat of the sun. Contract price was $5.50 per cu. yd. of the completed filling, and 28c per sq. yd. for the flush coat complete, and rolled.

ASPHALTIC CEMENT—PENETRATION

Fraser Avenue, South Vancouver

3,395 sq. yds done by contract. Contract price, $1.15 per sq. yd.

This contract provided for the cleaning of the road by water hosing, then for a primer coat of asphaltic cement at the rate of 0.4 gal. per sq. yd. On the primer coat was placed a layer of crushed rock at the rate of 0.075 cu. yds. per sq. yd. This was followed by the penetration application, which was made at the rate of 0.6 gal. per sq. yd., then a second layer of finer rock was spread at the rate of 0.015 cu. yds. per sq. yd., then the whole was well rolled. As soon as the rolling was done the sealing coat of asphaltic cement was spread at the rate of 0.2 gal. per sq. yd. and covered with a layer of torpedo gravel, after which the road was again thoroughly rolled. Great difficulty was experienced throughout the whole of the work, the contractors being unfamiliar with that class of paving material, or method of construction. The crushed rock supplied to the job was far from suitable, being much over size, and very dirty, there being difficulty at the time in procuring suitable rock for paving work. The contractors equipment was inadequate and there were many delays from this cause. The grade of the street averages 7 per cent., yet despite all the unfavorable conditions encountered in construction, and the position of the paving, it was, when recently inspected in good condition, with the exception of two small holes, these apparently due to a lack of asphaltic cement.

TAR—"LITHTA"—MIXING METHOD

No. 3 Road, Lulu Island, Richmond

Work was not completed this season. Contract price, $1.25 per sq. yd. Contract let under "patent," specification covering the use of Lithta which is a trade name for a brand if bituminous cement, made from coke oven tar. The contractors' equipment on this job was totally inadequate; this, coupled with difficulty in procuring crushed rock and the advent of winter weather, made it necessary to close down until next season. Work done by the same firm last year over another section of the same road, is becoming very wavy, particularly at the edges where the lower wheels of the traffic have "pushed" the material. The paving is quite soft, even at low temperatures, and the surface in places shows signs of scaling.

ASPHALTIC CONCRETE—MIXING METHOD

City of Vancouver

37,963 square yards; work done by contract; paving 1½ in. thick; price per sq. yd. $1.296.

This paving was all constructed upon old macadam surfaces. The cost of bringing these old surfaces to a suitable condition for base of the paving was a little less than 28c per square yard.

No. 3 Road Lulu Island, Richmond

12,242 square yards; work done by contract; price $1.90 per square yard. Paving 2 in. thick laid upon an old macadam surface; this is an excellent piece of work.

City and District of North Vancouver

22,000 square yards; work done by contract; paving 2 in. thick, contract let under "Bitulithic" patent, paving constructed upon an old macadam surface. This is an excellent piece of work. Contract price $1.85 per square yard.

City of Chilliwack

16,000 square yards; work done by contract; paving 2 in. thick. Contract let under "Bitulithic" patent, using gravel as the mineral aggregate. Not completed this season.

Little comment appears possible on these last four jobs, except to say that there is no reason to doubt but that surfaces will remain in first class condition, with a very slight maintenance cost for at least twelve years. Even at the present time a review of all the work done during the past season fully bears out the general estimate made of the values of the various types of surface.

Re Oiling Necessary

The oiled work all will require re-oiling as soon as possible this year. That at Penticton, although very carefully applied (hot and under pressure), failed, it may be said, as soon as the road was opened to traffic, one reason for this being that the road material was not sufficiently consolidated. The asphaltic flush cost was quite satisfactory, until, with the advent of winter, rough shod horse traffic caused considerable damage.

The Burnaby and South Vancouver "Tarvia" flush coat work will require fresh application this year, if the surfaces are to be maintained properly. It should be also taken into consideration that all the oiled and flush coat roads will require considerable expenditures to maintain them in addition to the oil or other bituminous flush coat work.

The asphaltic cement "penetration" job at South Vancouver, constructed under very adverse conditions, and which was quite expected to show signs of disintegration under winter weather, is really in good condition with the exception of the small holes noted. These would be likely to occur though in even the most carefully constructed "penetration" method pavin.

A reference was made, near the commencement of this paper, to exceptions to the deleterious effect of one or more of the divisions of the stress exercised by traffic on certain types of bituminous surfaced roads. The exceptions are live load and impact, both of which in some degree tend to keep a first class pavement in good order, in that their action nullifies the disintegrative effect of the expansion of the paving mixture arising from climatic change, and removes minor abrasions and openings on the surface of the paving caused by horse traffic at times when the temperature is high.

The beneficial action is referred to as "ironing," and this term is explicit, for wheel traffic "irons" the surface, sealing abrasions, etc., preventing the removal of particles from the road, and further maintaining the solidity of the surface.

The bridge of the future is destined to be the concrete bridge, according to Mr. Frank Barber, who delivered an address "Concerning Bridges" to the Toronto Branch, E. I. C., recently. "In a few years," he said, "concrete will have replaced steel entirely for bridge construction."

The Mount Royal Housing Company, Limited, Montreal, has been incorporated with a capital of $500,000 to carry on the business of a construction and land company.

American Water Works Association

Preparations Under Way for Large Convention in Montreal on June 21—24

THE American Water Works Association will hold its 40th annual convention in Montreal during the week of June 21. The headquarters of the convention will be at the Windsor Hotel, and the Windsor Hall will be used as an exhibition hall in which American and Canadian manufacturers of all kinds of water works equipment will have exhibits Professional meetings will be held every day of the convention which meets on June 21 to June 24 inclusive. At these papers will be read on matters of particular interest to water works men.

While the complete programme has not yet been prepared, it is announced that some important papers on water supply problems and conditions will be submitted. Mr. F. A. Barber, of Boston, will read a paper on the St. John, N. B., water works system, and it is understood that Mr. T. W. Lesage, former superintendent of the Montreal water works, will contribute a paper on the Montreal aqueduct system.

The membership of the American Water Works Association consists of managers and superintendents of water works, also consulting engineers and chemists, and the convention will bring together some of the most prominent hydraulic and water works engineers of Canada and the United States.

Reception and Dance

That the social side of the big gathering is receiving considerable care, is evident by the fact that the convention will be opened on the evening of June 21 with a reception and dance, and further the Montreal committee announce that the members of the association will be afforded every opportunity of visiting all points of interest in Montreal, and that they will take a trip up the Lachine canal and shoot the rapids. A ladies' entertainment committee has also been organized for the purpose of entertaining the visiting ladies.

The Montreal members of the association are at present very active in arranging all the details in connection with the convention during which the Canadian section of the association of about 100 members will be organized.

Messrs. T. W. Lesage, F. C. Laberge, A. Hutchinson, of Montreal, and J. J. Salmond, of Toronto, and C. W. Green, of Ottawa, are the entertainment committee, of which Mr. H. G. Hunter, of Montreal, is chairman. Mr. J. M. Diven, of 153 West 71st St, New York, which is the headquarters of the association, is secretary.

Contracts have been awarded by the following companies to the Automatic Telephones & Time Recorders, Limited, for service installations in various factories: Kipawa Company, for the plant and town at Timiskaming; G. E. Gooderham & Company, Richmond St. W., Toronto; Kaufman Rubber Company, Kitchener, Ont., and Canadian Consolidated Rubber Company, in the Dominion Tire factory at Kitchener.

The Recovery of Grease and Fertilizing Materials from Sewage Sludge

Value of Sludge for By-Product Recovery Depends on Short Period of Tanking and Speedy Utilization—The Cobwell Process Offers Possible Solution

By Raymond Wells*

VAST quantities of valuable materials are present in sewage, but so great is the dilution that methods of recovery readily applied in other waste reclamation are not applicable to sewage or sewage sludge.

Partial elimination of moisture by filter-pressing or centrifuging, followed by drying, would seem to be the simplest method of putting sludge into a valuable form. But, unfortunately, the almost colloidal character of the precipitate, and the amount of grease and metallic soaps contained, render pressing and centrifuging below 75-80 per cent. of moisture a difficult task. The subsequent evaporation of so great an amount of water in any type of dryer is most expensive, and odors given off are extremely disagreeable. Furthermore, in direct heat dryers, the volume of gases of combustion, together with the moisture-saturated air, is so great as to preclude any thought of condensing or scrubbing out the odors. For this reason alone, apart from the difficulties encountered in drying such a material, it is difficult to see any hope of solution in this direction. Moreover, the dried residue or tankage obtained by this method, while having considerable manurial value, is in a most undesirable condition for use as fertilizer or fertilizer-base goods.

Effect of Grease upon Fertilizer Value

This is due to the grease contained which, when it exceeds 8 per cent. in any tankage, renders its assimilation by the soil extremely difficult. Really, to complete the cycle of operation, the dried sludge should be percolated, the grease removed and the percolated tankage redried. Since, however, a large percentage of the grease present is in combination with alkaline earth and heavy metals in form of metallic soaps, it renders solution by simple percolation impossible. For this reason it is necessary to acidulate the sludge, prior to percolation, with some mineral acid, so that the fatty acids combined with metals as soaps will be liberated and put in such condition that they will be soluble in the usual solvents employed in percolation. This aciduation would have to take place prior to the drying operation in suitable lead-lined digesting apparatus, and no matter how carefully this operation were carried out, the wear and tear on the drying apparatus and the percolator, due to acid action, would render the operation very expensive and troublesome. Not only would the apparatus employed be very short-lived, but the action taking place between the liberated fatty acids and the grease in immediate contact with even a trace of mineral acid at high temperature would crack the fatty materials so badly as to render them valueless.

This was very evident in attempts by the writer to handle samples of sludge made by the Miles-acid process—by direct drying. At a certain point where most of the moisture was eliminated, charring took place with copious evolution of sulphur dioxide and acrolein vapors, and the grease obtained by subsequent extraction and distillation gave an extraordinary amount of tar and unsaponifiable matter. Not only does this reaction take place in the drying operation, but the solvent carrying the grease also carries with it small traces of mineral acid, which must be carefully washed and settled out before distillation for recovery of solvent. If this is not done, upon approaching a certain concentration in the still, violent foaming with evolution of sulphur dioxide and fatty decomposition products takes place, and again the grease is damaged.

It may be well to note that the mineral acid referred to is, of course, sulphuric acid, no other acid being available, on account of price, for use on such low-grade material. For these reasons, the operation of drying, percolating, re-drying, etc., so readily applied to other materials, seems not to be very successful when used on sewage sludge.

The Dewatering Problem

Destructive distillation of the dried or semi-dried sludge has been attempted, with the usual methods of recovery of the ammoniacal liquors and oils. Here again the problem of moisture elimination is intruded, and the recoveries made are not such as warrant the hope of even paying for the operation, much less of showing any profitable return. In both the cases of distillation of dried sludge and of garbage tankage, the experiments of the writer have in all cases failed to show a greater recovery of nitrogen in the ammoniacal liquors than 35-40 per cent. of that present in the original samples. As a rule, an additional 30 per cent. remains in the retort charcoal, with the residue passing off as nitrogen in the combustible gases. The oils passing over are of little value except as fuel. This seems to the writer a very expensive way of producing fuel oil.

Acidulation of semi-dried sludge from filter-presses or centrifuges, followed by drying in retorts, with subsequent distillation in current of superheated steam, to carry over the fatty acids liberated by acid, has been tried, but found unsatisfactory for many reasons.

Methods have been described and tested out on a large scale, attempting the direct extraction of greases from wet sludge by volatile solvents. In these processes, which are difficult and expensive to carry out, a partial solution of the free grease results, together with a portion of the waxes existent in sewage, and of soaps. The result is the formation of extremely resistant emulsions, which seem to defy any recovery treatment by distillation. After such an emulsified mass has reached a certain concentration in the solvent recovery stills, the whole charge expands into a foamy mass, in which, seemingly, a gallon will fill a large tank.

An endless number of methods and schemes have been tried first and last, but apparently none had sufficient merit to survive the first attempts. Possibly many failed under market conditions which do not exist at the present time, or, what is more likely, at their beginning they promised so much that mere partial success gave nothing but discouragement.

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*Consulting Chemist, Homer, N.Y.

Leaving the recovery method aside for the moment, has sewage sludge any inherent values, and, if so, what are they? What type and condition of the sludge offers the greatest possibilities?

Value of Sewage Sludge

Setting aside for the present the moisture content, the value of the sludge will be governed by its grease and nitrogen content, since, while all sludges contain small percentages of bone phosphate and potash, from a practical standpoint they may be neglected.

Consider the following analyses (dry basis):—

	Ammonia, per cent.	Grease, per cent.
Baltimore sludge, acid process, fresh	3.26	27.23
Boston sludge, acid process, fresh..	3.91	29.30
Chicago Sanitary District, activated, fresh..	5.10	14.70
Pleasantville, N.Y., setting basins, one month in basin	4.14	27.40
Syracuse, settling basin, fresh	4.92	9.60
Syracuse, activated, fresh	5.06	17.70

All of the analyses are from samples of sludge produced from comparatively fresh sewage, and are representative of sludge rapidly deposited and not allowed to rest in the tanks for any great length of time. For that reason little bacterial action had taken place, and the ammonia and grease content were at their maximum for the different types of sludge. Compare with these the analyses of samples of sludge from so-called septic tanks or sludge which has been exposed for a great length of time on drying beds:—

	Ammonia, per cent.	Grease, per cent.
Baltimore sludge from tanks, on bed approximately six months	2.24	1.50
Chicago activated, nine months old	4.40	5.00
Akron, O., three months in tank, six months on bed	1.00	6.00

All other things being equal, the value of a sludge for by-product recovery purposes depends upon the shortest possible period of tanking and shortest elapsed time between tank and ultimate utilization. In other words, bacterial action and weather erosion must be restricted to a minimum. This is directly contrary to usual sewage practice, and is one of the rocks on which the disposal proposition has stumbled. Below a certain minimum of recoverable values, there is no use attempting recovery. This minimum seems to be for low-grade ammoniates, such as garbage tankage and sewage sludge, approximately 3 per cent. ammonia. Below this the expense of handling and freight cost put it out of all hope of competition with other and more concentrated materials. From an economic and business standpoint, any goods falling below this rating had better be forgotten and no time wasted on developing methods of handling.

Moisture Content of Sludge

Moisture content of sludge leaving tanks is the next most vital consideration. In order to come within economic range of any method of artificial drying of any material containing 3 per cent. to 3.5 per cent. ammonia and 10 per cent. to 15 per cent. grease on a dry basis, moisture must not exceed 75 per cent. to 80 per cent. All sludges as they come from tanks or basins are far above this, and activated sludge a long way beyond. Sludge from ordinary sedimentation basins can be drained and air-dried within several weeks to 77 per cent. to 80 per cent. moisture, and by centrifuging to about the same amount. It would appear, however, that the simplest and most inexpensive method is that of depositing sludge after removal from tanks on drainage beds, exposed to atmospheric drying conditions. In any case, without the presence of water dumping facilities, the sludge must be partially dewatered before final disposition.

With sludge containing 75 per cent. moisture the ultimate disposition with by-product recovery is not impossible, though difficult and presenting many curious conditions.

To accomplish the disposal with production of a marketable tankage and grease, the elimination of all of the moisture with subsequent extraction of the grease by volatile solvents, a system of drying, extraction and recovery in one operation is suggested. Such a combined and complete operation is carried out at the present time only by the Cobwell process. This process, as is doubtless well known, is applied to municipal garbage, waste materials, slaughter-house offal, and other wet organic waste materials. At the request of several engineers and municipal officials, a number of small-scale and several large-scale experiments have been made on sewage sludge, with results which seem to warrant some hope of solution of the problem. (A short description of the Cobwell process appeared in the Contract Record of December 17, 1919, but a more comprehensive outline is given herewith).

Simultaneous Dehydration and Degreasing

In this method of dehydration with simultaneous degreasing, the principle employed is that of desiccation in a hot bath of an immiscible solvent, which shall serve not only as a dehydrating medium, but shall also during the period of drying continually dissolve the grease contained in the material to be dried. Such a solvent, preferably employed in the handling of sewage sludge, is a high-boiling petroleum naphtha, distilling within the range of 360 deg. Fahr. to 420 deg. Fahr., which corresponds to the first 60-70 per cent. over in the fractionation of "standard waterwhite kerosene." This material serves not only as the most economical heating medium, but, owing to the high temperature maintained in the desiccating mass, serves to remove or dissolve the metallic soaps as well as the free grease. Cold or merely warm solvents of a less oily nature have little solvent action on such soaps, but high-boiling oils, particularly when carrying small quantities of grease, are able to dissolve them without difficulty. Upon cooling they are apt to be deposited as jelly-like masses, or to cause the gelatinization of the whole solvent solution, and for that reason the solution must be treated before entering the recovery stills, in such manner that the soaps are decomposed and a solution of clean, fatty acids results. This treatment will be taken up in order.

The principal apparatus consists essentially of a closed tank, circular in shape, and a diameter three times the height. Jackets are provided on the bottom and well up the sides, so that as much available heating surface is obtained as is possible. Through the bottom, oblong, screened openings are provided for the withdrawal of solvent and grease and for pumping in solvent during the cooking or desiccating operation. Within the tank proper is a central shaft, provided with two sweeps set very close to the bottom, in such manner that they shall slide under the mass to be treated, imparting an undulatory motion, without cutting through the mass itself. For this reason very little power is required. The tanks are of shallow form, in order that the amount of heating surface in proportion to the mass to be treated may be as great as possible. Greater height and capacity could only be obtained at the expense of operating time and greater consumption power. The top of the tank is provided with a charging manhole and an outlet pipe for vapors to pass to the condenser.

After the tank is loaded with sludge the charging manhole is securely closed by the swing cover, solvent is admitted through the bottom screens, sufficient to immerse totally the mass of sludge, and steam is turned on the jackets. Combined vapors of solvent and water vapor pass out through the vapor line to surface condensers of suitable capacity, and in these the mixture of solvent and water vapor is condensed to a liquid, which leaves the tail pipe of the condenser and passes to a separating tank where, by virtue of the lighter gravity of the solvent, separation of solvent and water is effected. The solvent flows to storage for re-use. Owing to rapid evaporation, the solvent level is lowered in the tank, and a further quantity is pumped in.

Four to five hours are required for the evaporation of all of the water, and at this time, through the sight glasses, the dried fibre, etc., can be observed floating on the top of the solvent. At this point the agitator is stopped, the steam turned off, the drain valves opened, and the grease-laden solvent pumped. Several washes with fresh solvent complete the degreasing of the mass, which is then heated and agitated, and, with the help of live steam, freed from the absorbed solvent.

Treatment of Grease-laden Solvent

The solvent, carrying with it the extracted grease, soaps, etc., must receive preliminary treatment before passing to the solvent-recovery and grease-finishing stills. This treatment is carried out in a lead-lined tank provided with an agitator. To the solvent is added a sufficient quantity of sulphuric or muriatic acid and water to decompose completely the metallic soaps present. The acid water is well churned up with the solvent, and allowed to settle and drained off; fresh water is added, and mixed, allowed to settle, and the clear grease solvent solution is run to the recovery stills. By this treatment, foaming and other difficulties are avoided in the distillation, and the grease recovered does not form the emulsions, separated with difficulty, it is disposed to form. Such grease can be cleaned up and settled free from mechanical impurities and moisture, without undue trouble.

The entire cycle of operations takes place in a closed circuit, and the only vent for non-condensible gases for the whole system of tanks (or reducers), condensers, separating tanks, washers, stills and storage tanks, is on the final solvent storage tank or tanks. This vent exhausts through an oil scrubber to recover tracts of naphtha carried over by carburetting. During no period of the operation is the sludge exposed to the air or man-handled in any way, until it is finally discharged from the side door of the tank in a dried, degreased condition. The only places where odors or noxious effluent are exposed to the air and liable to cause an unsanitary and nuisance condition, is at the gas vents on the storage tanks and at the effluent overflow on the separating tank. This effluent is, of course, distilled water from the sludge, and carries with it the odor of the sludge, which, in the case of fresh sludge (and that is preferably handled) is very offensive. The quantity of this water equals that contained in the sludge prior to desiccation, and the condensed steam from the steaming out of the solvent from the drained sludge, prior to dumping from the machine. This approximates a ton of effluent for every ton of sludge handled. The only way found by the writer to effect deodorization of this effluent, and to render it harmless, is by the addition of chlorinated lime or chlorine water. The greatest amount necessary for deodorizing very foul water is one part of 35 per cent. available chlorine bleaching powder to 3,000 parts effluent. The non-condensible gases leaving the storage-tank vents must be scrubbed with chlorinated-lime solution before being allowed to pass to the atmosphere.

No Offence

With these precautions it is safe to say that the entire operation of desiccation and degreasing, or the whole recovery operation, can be carried out with no offence.

In handling sewage sludge by this method no difficulties have arisen other than those usually met with in handling wet organic materials of other sorts, and since in sludge the moisture is present in free condition, mechanically combined, the period required for desiccation is much shorter than that met with in the treatment of garbage and animal refuse, in which the larger part of the water is more or less chemically combined. For this reason only four or five hours are required for drying a given amount of garbage.

Trial runs indicate the capacity of each tank as 8 tons in twenty-four hours, and that for a plant handling the sludge from a town of 200,000 inhabitants (approximately 40 tons 75 per cent. moisture basis daily), the cost for handling, including overhead and fixed charges, will approach $6 to $6.50 per ton on green sludge. This cost would not be greatly changed in handling sludge containing 75 per cent. or 50 per cent. moisture, but since the gross tonnage to be handled would be greatly reduced, the plant investment would be much less, and therefore the by-product returns per green ton much greater. If by any method of dewatering on beds, or other inexpensive method, the moisture can be reduced below 75 per cent., by just so much will the success of a recovery plant pass from just self-maintenance to a possible profit.

Yield of Grease and Tankage

After carrying out such an operation, what possible yield of by-products may be expected, and what is their character and what their value? This depends entirely on the nature of the sewage handled. It has been presupposed that any sludge running less than 3 per cent. of ammonia on a dry-tankage basis is not worth handling—unless, indeed, the grease content is very high, in which case it is possible that the grease alone might pay for recovery. From an average of a number of analyses, however, it would seem that a sludge low in ammonia is also low in grease, so that a 3 per cent. ammonia tankage would indicate a 15-25 per cent. grease content on a dry basis. For these reasons, in handling a 75 per cent. moisture sludge a yield of 430 lb. of tankage and 75 lb. of grease may be expected.

What is the nature of this grease and tankage? Have they any market value? What use to rescue this material if it cannot be sold or used? This is not a matter to be dismissed off-hand. At the present time, if either or both of these products were thrown on the market, emphatically they would not find a purchaser, or certainly the price would be absurdly low. Consider the nature of these by-products as indicated by their analyses:—

Analyses of Greases from Different Types of Sludge

	Free fatty acid, per cent.	Nonsaponifiable, per cent.	Neutral, per cent	Moisture, per cent.
Baltimore (acidulated) ..	77.48	11.78		10.74
Chicago (activated)	48.80	24.40	19.1	7.70
Syracuse (sedimentation).	51.50	19.30	18.70	10.50
Pleasantville, N.Y., (sed.).	75.70	19.80	4.50	

Boston Moon Island (sedimentation):

	Per cent.	
Free fatty acid (as oleic)	48.40	
Free fatty acid (by weight) ..	40.19	
Rosin acids (in fatty acid) ..	14.36	
Fatty acids (by difference) ..	25.83	
Unsaponifiable	21.09	
Neutral grease (by weight).. ..	20.00	(molecular weight of neutral fatty acids 272)
Metallic soaps and solid impurities..	3.30	

The first four analyses are of grease recovered in the process outlined, and it will be noticed that, in the first three, large quantities of solid impurities and moisture are recorded. All grease of sewage-sludge origin on leaving stills contains large amounts of such impurities, since, due to the emulsifying action of the waxes present in the so-called unsaponifiable, it is very difficult to obtain clean greases without subsequent washing with acid and settling. The fourth analysis is of a grease after such treatment.

Saponifiable and Unsaponifiable Matter

These analyses are of several different types of sludge and sewage treatment, yet all present the following general characteristics:—

The saponifiable matter in each case consists for the most part of free fatty acids and a very small portion of neutral grease or combined glycerides. This is, of course, anticipated by the fact that the greater part of the grease present in sewage sludge comes from hydrolysed soap solutions, or through the action of bacteria and ferments neutral grease has been broken down into fatty acids and glycerine. In any event, the neutral grease present gives no hope of glycerine recovery, so at once the so-called grease falls into the grade of poor-class fatty-acid stock. Of the total fatty acids present, varying in a number of analyses, from 1 per cent. to 15 per cent. of the total consists of resin acids. These again are from the soap solutions.

The unsaponifiable matter varies between 10 per cent. and 30 per cent., but a majority of samples analyzed show an average of 20 per cent. As may be supposed, the lowest percentages are found in strictly domestic sewages, where they are traceable to body waxes and products of physiological action. In mixed sewage from manufacturing towns the unsaponifiable is highest, as it is made up of mineral oils, thrown out from different factories, mills, etc.

Small percentages of metallic soaps of calcium, iron, aluminium and magnesium are present, but upon proper treatment are broken down into fatty acids and mineral salts, washed out as sulphates or chlorides, dependent on the sort of acid used for refining.

From these premises it is necessary to conclude that sewage grease can be regarded only as a very low-grade fatty-acid stock containing 70-75 per cent. of fatty acids and 25-30 per cent. of unsaponifiable matter. These fatty acids, depending on the sewage from which they are extracted, will vary in color from a dark ruby red to a black tarry-looking mass. In consistency the variation is between a soft, buttery mass and a hard and solid cake. This is quite readily explained. The former is very high in fluid-mineral and industrial-refuse oils, the latter, from domestic sewage in which the high-melting-point fatty acids have been hydrolyzed and precipitated from the soap liquors, whereas the oleic-acid soaps or oleic acid present in mixed soaps remain in solution and pass off with the effluent.

Fatty Acids Have No Market

Fatty acids of this type have no legitimate market at this time. Such materials are only valuable as they are refined and made into marketable products. A purchaser of sewage grease would expect by his own efforts to give it all of the value it might ultimately have, and, having created something out of nothing, would care to pay little for the raw material. That sewage grease in refined or manufactured form has value is not to be questioned. Such a grease as that indicated in analyses of the Pleasantville sludge grease, upon distillation in the manner usually employed for fatty acids, gave the following percentage yields:—

Light colored distillate	85
Still returns	9
Stearine pitch	6
Loss	3

The distillate was orange yellow in color and of high titre, and upon pressing gave 50 per cent. of good-colored stearic acid of titre 53.3 deg. C., and 50 per cent. of red oil containing 38.25 per cent. unsaponifiable matter. Upon pressing, all unsaponifiable matter passes out of seeded or crystalline cake in the red oil, leaving good stearic acid behind. This red oil is marketable for grease compounding and as wool oil. In other words, sewage grease must be manufactured to have value. Once its value is established, a market will be automatically created for the raw grease.

Upon whom shall the burden of carrying out these operations fall? Shall each sewage plant carry out the whole work from sewage to finished product? Shall a number of sewage plants pool their sludge, or their raw grease and tankage, and finish at a central plant, or shall a number of plants interest directly a corporation or individual able to carry out the refining operation? At this point sewage sludge ceases to be a problem for the scientist and becomes a purely business proposition.

The Commercial Aspect

Returning to the question of disposition of the tankage, it would require considerable propaganda to place upon the fertilizer-goods market a low-grade 3 per cent. ammoniate, cursed with the name sewage

No. 15

Canada's Contractors—John Quinlan

Some of the most important building contracts in Eastern Canada have been carried out by John Quinlan and Company, building contractors, of Montreal. Mr. John Quinlan, head of this firm, has been a leading figure in the building world for the past thirty years and has been responsible for the carrying out of a great many contracts, chiefly in Quebec. He is also president of the Quinlan Cut Stone Company.

When only twenty years of age Mr. Quinlan was general manager of Quinlan and Turner, general contractors, Montreal, but after four years' service with this firm he started in business for himself. The following are some of the contracts since completed by John Quinlan & Company: United Shoe Machinery Company's buildings, Montreal; Alexandra Hospital, (5 buldings), Montreal; Montreal Light, Heat and Power Co's. office bldg., Montreal; La Corona Hotel, Montreal; St. Peter's Church, Sherbrooke, Quebec; Montreal High School, (foundations); Post Office, Westmount, Quebec; three gas retort houses for the Montreal Light Heat and Power Company; St. Anne de Bellevue Military Hospital (3 units); Montreal Civic Library; Montreal Civic Garage; Sun Life Building (foundations), Montreal; Sacred Heart Convent,, Sault au Recollect, Quebec;, Dominion Express Building, Ottawa; Church of the Messiah, Montreal; St. Patrick's Orphan Asylum, Outremont, Que. His firm is now engaged in excavation work for the new extension to the Chateau Frontenac, Quebec.

As president of the Quinlan Cut Stone Company, Limited, Mr. Quinlan is known from coast to coast, having supplied stone for buildings as far west as Alberta. The following are a few of the buildings supplied with cut stone by this company: Provincial Parliament Buildings, Edmonton; Land Titles Buildings, Calgary; Lieutenant Governor's residence, Strathcona, Alberta, and five post offices in Montreal, including the main office.

Mr. Quinlan is an ex-president of the Montreal Builders' Exchange, and has taken an active interest in the affairs of that association since its inauguration, particularly in the general contractors' section.

Mr. John Quinlan

sludge, though in the old days of poudrette and natural guano it had an enhanced value in the public mind far greater than its chemical value indicated. The great diluent of sewage tankage is insoluble ash or mineral matter, running from 40-70 per cent., with 60 per cent. as an average. It is not impossible to concentrate this, though methods are not yet complete for doing so. A number of experiments conducted by the University of California indicate that, for percentage of nitrogen contained, degreased sludge has a higher plant food value than dried blood or high-grade tankage.

Even with reasonable markets for the tankage and grease, it is a question whether it is possible to recover enough materials to defray the cost of the operation. In the opinion of the writer, and from experience in the garbage-reduction business, it does not seem impossible, though there would be little margin of profit left. But the sludge would be disposed of, its disposition paid for and a large amount of needed materials returned to active use to assist in helping out the world's supply of chemicals and greases. The individual city would receive no monetary return, probably, but virtually to create actual, concrete products of economic value, to pay for the creation and at the same time solve a troublesome disposal problem, is something worthy of consideration.

With ordinary sedimentation of suspended solids, it is not at all unreasonable to expect from the sewage of a town of 150,000 persons daily recoveries of 5 tons of tankage and 1 ton of grease. There are many towns of this size. Any city of this class which can return to a useful cycle $50,000 worth of needed materials annually should consider well the disposition of its sludge pile.

Solving the problem of sludge disposal is not impossible, but it is difficult. No chemist, engineer, business man or politician can solve it alone. A co-operation which has not heretofore existed must be brought about before there can be any hope of solution.

The foregoing paper was presented by the author at the convention of the American Society for Municipal Improvements.

Brantford to Build Large Concrete Bridge

The city council of Brantford, Ont., have retained the E. A. James Company, Limited, consulting engineers, of Toronto, to design a reinforced concrete bridge to replace the Lorne Bridge over the Grand River in Brantford. The new bridge contemplated will comprise two 175 ft. reinforced concrete arches. The bridge will be 60 ft. wide and will accommodate a double track car line. The estimated cost is $211,000. Plans are under preparation by the engineers and it is the intention to call for tenders next winter and commence construction early in 1921.

Demand in Cuba for Granite Blocks

Trade Commissioner Hugh A. Chisholm, Cuba, writes that there is a big demand in Cuba for granite blocks for paving purposes of the following specifications: 8 inches to 12 inches long, 3½ inches to 5 inches wide, 4½ inches to 5¼ inches deep, 36 blocks to cover 1 square metre. At present these come from Norway in ballast at a price of $110 per 1,000 blocks c.i.f. Havana. If Canadian firms can meet this price good contracts can be arranged.

Municipally Owned Asphalt Plants

We are indebted to the Milton Hersey Co., Ltd., for the interesting information that the following Canadian cities now have municipally owned asphalt plants. This list is a revision of a previously published list: Charlottetown, P.E.I.; Chatham, Ont.; Hamilton, Ont.; Kingston, Ont.; London, Ont.; Montreal, P.Q.. (4 plants); Ottawa, Ont.; Sherbrooke, Que.; Toronto, Ont.; Victoria, British Columbia; Winnipeg, Manitoba.

Most Bridges are Too Light

Most of the bridges in Canada, according to Mr. Frank Barber, consulting engineer, Toronto, are too light for the traffic that they have to bear, and in many cases are decidedly dangerous. The construction of the bridges of a country, he believes, indicates the difference in the character of the society, the wooden or lighter bridge corresponding to a pioneer state of society, where only the thought of traffic prevailed in their construction, and not durability or beauty of design.

Water Power Development in Canada

2,417,896 Turbine or Water Wheel Horse Power Installed—Analysis of Distribution—73 Per Cent. in Central Stations

The Dominion Water Power Branch, Department of the Interior, and the Dominion Bureau of Statistics, Department of Trade and Commerce, have, through co-operation, just completed a census and analysis of the developed water power in Canada. The figures, which are complete to January 1st, 1920, are exceptionally interesting and are indicative of the manner in which the water power resources of the Dominion are being put to advantageous use. Practically every great industrial centre in Canada is now served with hydro-electrical energy and has within easy transmission distance reserves of water power.

According to a recent computation the water power resources of the British Empire have been placed at from 50 to 70 million horse power. This does not include such territories, formerly under control of the Central Powers, as will fall in future under British influence. To this total Canada contributes in the neighborhood of 20 million horse power. This figure represents the power available at sites at which more or less definite information is to hand. Continued investigation will undoubtedly add to this figure.

According to the statistics just compiled there is installed throughout the Dominion some 2,418,000 turbine or water wheel horsepower (Table 1), of which 2,215,000 horsepower is actually and regularly employed in useful work. The larger figure includes the total installed capacity at full gate, including reserve units. It does not, however, include hydraulic exciter units. A large number of the plants now operating are designed for the addition of further units as the market demands. The ultimate capacity of such plants, together with that of new plants now under construction, total some 3,385,000 horse power.

Of the total power installed 1,756,791 h.p. or 72.7 per cent., is installed in central electric stations. Central station power is sold for lighting, mining, electro-chemical and electro-metallurgical industry, milling and general manufacturing. It is apparent, therefore, that the central station total listed in Column 3, includes a portion of the totals listed in Columns 4 and 5, as used in other industries. In the pulp and paper industry 473,265 h.p. is utilized, of which 381,631 h.p. is generated directly from water in pulp and paper establishments, while 91,634 h.p. is purchased from hydro central electric stations.

Hydro power used for other purposes and other industries may be listed as follows:—for lighting purposes,

Table 1.

Distribution of Developed Water Power in Canada by Provinces and by Use of Power, January 1st, 1920.

DEVELOPED WATER POWER

	Total Water-wheel and T'bine Horse Power Installed	Totol Waterwheel and Turbine H.P. Installed for use in			Total Horse-Power actually employed	Ultimate Designed Capacity of Plants now operating or under construction in H.P.	Installed H.P. per 1,000 Population	Undeveloped Water Power
		Central Electric Stations	Pulp and Paper Industry	Other Manufactur'g Industries				
1	2	3	4	5	6	7	8	9
Yukon	13,199	10,000	......	......	11,349	13,199	1,467	100,000
British Columbia	308,167	211,043	46,962	46,094	276,795	350,832	429	3,000,000
Alberta	32,992	32,580	......	17	31,754	33,070	56	466,000
Saskatchewan	......	......	......	......	......	......	....	567,000
Manitoba	83,447	71,790	......	......	75,100	297,047	135	3,218,000
Ontario	1,015,726	794,621	158,095	99,230	934,015	1,460,920	360	5,800,000
Quebec	910,029	623.088	249,332	270,961	838,071	1,146,465	391	6,000,000
New Brunswick	18,080	9,378	2,693	6,009	16,657	29,115	40	300,000
Nova Scotia	34,323	4,064	16,183	12,276	29,359	52,202	66	100,000
Prince Edward Island ...	1,933	227	......	1,789	1,621	1,958	21	3,000
Totals	2,417,896	1,756,791	473,265	436,376	2,214,721	3,384,808	274	19,554,000

Note.—The central station power listed in Col. 3 is developed for sale. Part is sold to pulp and paper and other industries, and such part is included in Cols. 4 and 5 along with the power that is directly installed in these industries.

There were exported from plants included in the tabulation, 175,000 horse power years in the year ending March 31st, 1919.

Table 2

Turbines and water-wheels installed in water power plants in Canada by number and capacity of units and by provinces, January 1st, 1920.

	Total Water-wheels and Turbines Installed H.P.	Units of 100 H.P. or under		Units over 100 H.P. and under 500 H.P.		Units of 500 H.P. and under 2,000 H.P.		Units of 2,000 H.P. and under 5,000 H.P.		Units of 5,000 H.P. and under 10.000 H.P.		Units of 10,000 H.P. and under 20,000 H.P.		Units of 20,000 H.P. and over	
		NO.	H.P.	NO.	H.P.	NO.	H.P.	NO.	H.P.	NO.	H.P.	NO.	H.P.	NO.	H.P.
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Yukon	13,199	6	199	..	......	3	3,000	..	......	2	10,000	..	......	..	......
British Columbia..	308,167	124	4,396	43	10,498	39	44,573	19	62,100	6	42,000	12	144,600	..	......
Alberta	32,992	9	492	5	900	..	......	2	8,000	4	23,600	..	......	..	......
Saskatchewan. . .	......	..	......	..	......	..	......	..	......	..	......	..	......	..	......
Manitoba	83,447	..	......	1	450	2	1,000	9	35,597	8	46,400	..	......	..	......
Ontario	1,015,726	734	32,190	182	39,844	147	155,062	77	186,380	14	88,050	36	474,200	2	40,000
Quebec	910,029	893	31,942	189	46,626	140	151,461	51	157,825	22	151,075	20	251,100	6	120,000
New Brunswick .	18,080	61	2,084	16	3,696	10	10,300	1	2,000	..	......	..	......	..	......
Nova Scotia	34,323	324	8,968	38	9,605	19	13,250	1	2,500	..	......	..	......	..	......
Prince Edward Isl.	1,933	93	1,933	..	......	..	......	..	......	..	......	..	......	..	......
Totals	2,417,896	2244	82,204	474	111,619	360	378,646	160	454,402	56	361,125	68	869,900	8	160,000

434,613 h.p.; in mining industry 177,728 h.p.; in flour and grist mills, 42,736 h.p.; in lumber and saw mills, 37,918 h.p.; in other manufacturing industries, 172,955 h.p. These figures are evidence of the widespread manner in which the Dominion's water power resources are being applied to the furtherance of its industrial development. In further reference to the foregoing total of water power developed in Canada, it might be noted that during the fiscal year ending March 31st, 1919, there were exported from plants included in tabulation, 175,000 h.p. years.

Table 2, analysing the number and capacity of the water wheels and turbines installed, is of considerable interest. The total installation of 2,417,896 h.p. is comprised of 3,370 units, of an average capacity of 715 h.p. While 2,244 of these units are of 100 h.p. or under, they contribute only 82,204 h.p. or 3.4 per cent. of the total. A total of 1,845,427, or 76.3% of the whole, is contributed by units of 2000 h.p. and over; 1,391,025 h.p. or 57.6% by units of 5,000 h.p. and over; 1,029,900 h.p. or 42.6% by units of 10,000 h.p. and over; and 10,000 h.p. or 6.6% by units of 20,000 h.p. and over. This table is illustrative of the modern tendency towards the installation of large units. Reference might be made in this connection to the 50,000 h.p. turbines which are contemplated for the new development of the Hydro-electric Power Commission of Ontario at Queenston.

The statistics in Table 3 refer to the developed water power used in connection with the central electric station industry. The central station industry has made great strides in Canada in recent years. A network of transmission systems, which are being rapidly extended from year to year, covers central and southwestern Ontario and southern Quebec. Other systems established in numerous centres from coast to coast are likewise rapidly extending their scope. 91.4 per cent. of the primary power used in the central stations throughout the Dominion is derived from water, evidencing the advantageous location of the water power resources to industrial centres.

The total installed water wheel and turbine horse power in hydro central electric stations is 1,756,791 h.p. Fuel auxiliaries installed as stand-bys to these hydro stations bring the total installed primary capacity up to 1,873,989 h.p. connected to 1,449,180 kv.a. dynamo capacity. The total capacity invested in these central stations, inclusive of transmission and distribution systems, is $369,464,961 or an average of $210 per installed primary horse power.

Of special interest to engineers is the actual cost of construction of hydro-electric power stations, exclusive of transmission and distribution systems. The figures of 70 representative hydro-electric stations throughout the Dominion with an aggregate turbine installation of 745,797 horse power, show a total construction cost of $50,740,468 (pre-war figures) or an average of $69.11 per installed horse power. This cost includes the capital invested in construction of dams, flumes, penstocks, and all hydraulic works, and of power stations and equipment. It excludes real estate and transmission and distribution equipment. The figure, in brief, represents the capital cost of construction at the power site.

With a water power development of 274 h.p. per thousand population, Canada stands well in the forefront in respect to availability and utilization of hydro power resources, being only surpassed in this respect by Norway. The enormous water power reserves still untouched form a substantial basis for the progressive exploitation and development of other natural resources, and, if properly co-ordinated with the development and utilization of the enormous fuel resources of the Dominion, are an assurance of continued industrial expansion and prosperity.

Table 3

Central electric stations operated by water power—Primary horse power and dynamo capacity installed and capital invested in stations and transmission and distribution systems, January 1, 1920.

	Installed Horse Power in			Total Installed Dynamo Capacity in K.V.A.	Capital Invested	
	Waterwheels and Turbines	Fuel Auxiliaries	Total		Total	Per Horse Power
1	2	3	4	5	6	7
Yukon	10,000	......	10,000	6,000	3,471,678	347
British Columbia	211,043	26,780	237,823	154,571	38,450,131	182
Alberta	32,580	2,405	34,985	24,260	6,990,972	214
Saskatchewan	......	......	......	......	....	...
Manitoba	71,790	19,400	91,190	62,313	14,340,458	200
Ontario	794,621	39,530	834,151	670,053	170,112,988	215
Quebec	623,088	28,163	651,251	522,461	133,645,655	214
New Brunswick	9,378	500	9,878	6,160	1,543,727	165
Nova Scotia	4,064	420	4,484	3,016	842,122	207
Prince Edward Island	227	......	227	346	67,230	296
Totals	1,756,791	117,198	1,873,989	1,449,180	369,464,961	210

Mainly Constructional

East and West—From Coast to Coast

The County Council of Welland, Ont., has set aside $250,000 for road construction this year.

Work has been commenced by the Price Bros. Company on the construction of a model city at Saguenay, Que.

The ratepayers of Port Dalhousie, Ont., recently voted in favor of the installation of a waterworks system for the town.

The contractors of St. John, N. B., have formed a branch of the Association of Canadian Building and Construction Industries.

Messrs. Angstrom & Verochio Co,, Ltd., contractors, of Toronto, have removed their offices from the Lumsden Bldg. to 81 Victoria St.

The Canada Wire & Cable Company, Leaside, Ont., are building 28 houses for their employees, and a sewerage system will be laid to serve these dwellings.

The Amalgamated Association of Sheet Metal Workers, at Toronto, have refused to arbitrate their wage demand of 90 cents an hour, with the Builders' Exchange.

A new company to be known as the Yarmouth Housing Company has been organized at Yarmouth, N. S., with the following officers: President, J. D. Kirk; secretary-treasurer, W. G. Kirk; managing director, Andrew Kirk.

Mr. A. W. Hall, Town Planning Commissioner of the Ontario Bureau of Municipal Affairs, was in London, Ont., recently and inspected sites and plans for the new group of dwellings to be erected by the Housing Commission there.

The city of Regina, Sask., will expend $530,000 on public improvements during the coming summer. This sum does not include the cost of the proposed extensions to the sewerage and waterworks systems, which will be added at a later date.

Building Inspector E. H. Rogers, of Winnipeg, estimates that between 2,500 and 3,000 dwellings are needed in Winnipeg to accommodate those seeking homes. It would cost in the neighborhood of $16,000,000 to carry out a programme of this size.

As a result of recent examinations held at Victoria, B. C., the following have been qualified to practice as land surveyors in the province of British Columbia: Messrs. R. O. Leslie, James T. Fullerton, E. C. McNary, Robert Bell-Irving and Frank P. Allwood.

It has been announced that the International Engineering Corporation of Indiana will locate a branch in Waterloo, Ont., where they will manufacture their line of crude oil engines. The firm has secured a five acre site, centrally located, and will erect three one-storey buildings, 50 by 100 ft.

At a recent meeting of the Grand River Valley Board of Trade, at Galt, Ont., Mr. W. H. Breithaupt, of Kitchener, Ont., presented his scheme for flood prevention on the Grand River. After some discussion, it was decided to send a delegation to Toronto to interest the Provincial Government in the possibilities of this scheme.

The National Waterways Association has opened offices at 306 Stair Building, Toronto. The object of the association is to further the development of a deep waterway between the Great Lakes and the Atlantic Ocean. Dr. E. Herbert Adams is chairman of the Organization Committee and James H. Duthie, secretary.

The councillors selected at the annual meeting of the Provincial Builders' Exchange of Saskatchewan, to represent that association at the meeting of the Saskatchewan branch of the Association of Canadian Building and Construction Industries, to be held in Saskatoon in June, were Messrs: Joseph Shannon, of Saskatoon; George Forbes, of Moose Jaw, and W. A. Wilson, of Regina.

It is announced that the Grand Trunk Railway will shortly commence construction of a water pipe line from the Crooked Lakes in Qu'Appelle Valley to Melville, Sask., a distance of 27 miles, at a cost of about $250,000. The company has decided on this undertaking owing to the fact that the water obtainable at Melville, at the present time, is not suitable for the engines, as it contains too much alkali.

Personal

Mr. Geo. F. Main has resigned from the Town Planning Committee, Hamilton.

City Engineer Fellowes, of Vancouver, has returned to that city after an absence of a month in Ottawa.

Mr. Frank A. Coombe has resigned the position of chief engineer of Babcock & Wilcox, Ltd., Montreal, to enter private practice.

Mr. R. J. Leckie, Regina, was elected president at the annual meeting of the Provincial Builders' Exchange, held in Saskatoon recently.

It is announced that Mr. A. P. Kapelle, secretary of the Works Department, Hamilton, is leaving the department at the end of the month.

Mr. H. B. Muckleston has been appointed chief engineer of the Lethbridge Northern Irrigation District, Lethbridge, Alta. Mr. Muckleston was formerly with the Department of Natural Resources, Calgary, Alta.

Mr. A. G. Bailey, formerly of Morris Knowles, Inc., Pittsburgh, has entered upon his new duties as manager of the Canadian organization of Morris Knowles, Ltd., succeeding Mr. C. W. Tarr, who resigned recently.

Mr. Fred Early has resigned his position as secretary of the Hydro-electric and Water Commissions, at Brampton, Ont., to take over the position of engineer in charge of the construction of the town's new filtration plant.

Mr. S. W. Crowell, town engineer and superintendent of waterworks, Yarmouth, N. S., tendered his resignation at a recent meeting of the town council. Several applications for the position have been received by the council.

H. J. Griswold, who in May 1918, was engaged from the Dominion Engineering & Inspection Company to organize and operate the Canadian branch of Messrs. MacGovern & Company, Inc., of New York City, is completing a two year contract on June 1st and will then resume active participation in the affairs of the Dominion Engineering & Inspection Company in which he is a partner.

Obituary

Mr. John H. Bennett, contractor, of Toronto, died recently at the Western Hospital as a result of septic poisoning.

Mr. A. Macdonald, well-known railway contractor, of Vancouver, B. C., died recently at his home in that city, following an acute attack of Bright's disease. He was born at Kirkfield, Ont., in 1876 and went to Vancouver in 1911, where he was for many years superintendent of construction for the Canadian National Railways. One of Mr. Macdonald's most recent undertakings was the large C. N. R. warehouse on False Creek.

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Is it Fair for Canadian Concerns to Employ Foreign Architects?

CANADIAN architects have on many occasions strongly protested against the employment of American architects on Canadian work. In some instances, the retaining of specialists, such as architects who have specialized on planning hospitals, may be justified, but it is generally felt that the engagement of architects from across the border on ordinary work is unfair to Canadian professional men, especially in view of the obstacles which are placed in the way of the employment of Canadian architects in the States.

It is not surprising that American firms who build branches on this side should prefer to engage architects who have previously erected buildings for them in the States, and who presumably are better acquainted with the exact requirements of their clients than Canadian architects. The chief complaint, however, is directed against the giving of retainers by Canadian firms, who are making their profit out of people in this country, and who rely on Canadian business to keep them going. If such firms desire the support of our people, then, in fairness, they should support Canadian professional men when opportunity serves. In two or three recent jobs in Montreal, American architects have been engaged—one instance is that of an institution of a national character, with Canadian capital, Canadian directors, and relying on the Canadian people for business and consequently for its dividends. In another instance the Canadian public have been asked to subscribe capital for the extension of the enterprise, an extension which is to be constructed from plans drawn by an American architect.

From the contractor's supplies firms' point of view, the engaging of outside architects is by no means satisfactory. American architects naturally specify materials with which they are familiar, and, if we are to rely on the statement of Canadian supply houses, this too often means that Canadian materials are ignored, and that American sub-contractors are brought in to the loss of home firms.

Some architects do not take the views outlined above. They affirm that competition from any source is likely to result in much better work; that some of the finest buildings here are the result of work done by Americans; and that if the latter can give better service than our own professional men, then we cannot expect to obtain commissions for the highest class of buildings. They also point to the first class work done by Canadian branches of American contracting firms, and argue that under the stimulus of competition, Canadian contractors have made splendid progress in their business. Without such competition Canadian contractors would not have reached the point at which they now stand.

Evils of Sectionalism Aggravated by Proposed Zone Postal Schedule

THE Post Office Department is no longer to be considered a servant of the people, managed with a view to encouraging communication between the scattered people of Canada It is a money-making, revenue-raising branch of Government activity, aiming to show a large annual surplus as evidence of work well done.

As if there were already not enough influences at work promoting class and territorial distinctions, furthering sectional as opposed to national interests, the Post Office authorities now propose to divide Canada into zones, and so far as they can control it, keep the circulation of our newspapers and nationally-circulated periodicals from reaching citizens outside a limited circle. The citizen out West who wants to keep in touch with affairs "back home" is not going to continue doing it at the expense of the Post Office Department, if the postal authorities have their way.

The ideals and purposes of Confederation are to be ignored. All the patient, nation-building efforts of half a century would be thwarted, Canada split into sections, the evils of sectionalism aggravated, all to yield a few hundred thousand dollars to swell a surplus already in the millions.

The purpose is to increase the postal charges as much as 800 per cent. in order to discourage the wide circulation of the few periodicals now carried through the mails outside a limited zone. Publications which are of common interest to all Canadians are to be penalized, to the encouragement of sectional publications, and to the further advantage of United States and other foreign magazines—if the postal authorities have their way.

The publishers are protesting—not against fair taxation, nor against fair postal rates—but against a postal policy which does not recognize Canadians as one people, all entitled to equal treatment as regards postal rates—against any policy which would sacrifice Canada's few nationally circulating publications to the advantage of many times their number of American publications coming into the country tariff-free.

Can this sort of thing be called "union" government?—Marketing.

New Map of Canada Shows Location of Resources

A "MAP of the Dominion of Canada indicating natural resources, transportation and trade routes," scale 100 miles to the inch, has just been published by the Department of the Interior. On this map varieties of mineral, agricultural and fishery resources, and the timber and fur in general are printed in red lettering in their proper locations. The sites of important water powers, developed and undeveloped are indicated, and the lines of all railroads completed up to date are clearly defined. The resources shown on the map extend from "whales" near Herschel island in the Arctic to "salt" at the southern toe of the Ontario peninsula, and from the "white whales" of Ungava bay to the fruit lands near Victoria, B. C. An important insert contains five circular diagrams, showing the comparative contributions of each province to field crops, commercial timber, developed water power, fisheries and minerals. A sixth diagram displays the proportion of the total exports filled in 1918 by manufacturers and by the five great classes of natural resources severally.

The thorough reliability of this map is shown by the caution which ignores probabilities however promising. The trader, investor, manufacturer and economic student will read the map as an open book; its appearance is timely when demand is abnormal and enlarged production a necessity.

The map may be obtained free of cost on application to The Superintendent, Natural Resources Intelligence Branch, Department of the Interior, Ottawa.

Canadian Engineering Standards Association Reports Progress

A MEETING of the main committee of the Canadian Engineering Standards Association was held at Ottawa on April 12th, Sir John Kennedy in the chair, when a number of items of interest were dealt with.

The general specification for steel railway bridges submitted to the main committee by the sectional committee on steel bridges and construction was approved for publication. This specification, the essential provisions of which are fortunately in general agreement with the practice of the American Railway Engineering Association, is not drawn up with any intention of limiting the choice of the engineer as to type of bridge, but is so framed as to indicate definite methods of work for the designer, detailer and manufacturer, with a view of thus obtaining uniform results as regards strength and utility. The specification, as now approved, is based on that published in draft form in 1918 by the Engineering Institute of Canada, and drawn up by a committee of that Institute under the chairmanship of Mr. P. B. Motley, engineer of bridges, Canadian Pacific Railway Company. The work of the C. E. S. A. upon it was undertaken at the request of the Engineering Institute of Canada.

Wire Rope Specifications

It is announced that sub-committees have been appointed for the purpose of drafting general specifications for guidance in the purchase of wire rope, both for mining purposes and for dredging and steam shovel work. The former sub-committee is under the chairmanship of Mr. F. H. Sutherland, Inspector of Mines of Ontario, and the chairman of the latter is Mr. K. M. Cameron, Department of Public Works, Ottawa.

A report from the chairman of the sub-committee on telegraph and telephone wire, Mr. W. J. Duckworth, of the Great North Western Telegraph Co., Toronto, stated that a specification for two standard grades of this material had been drafted and was now being considered and amended by the sub-committee.

Mr. J. G. Morrow, Steel Company of Canada, Hamilton, chairman of the sectional committee on steel, reported that a special committee had commenced work with a view to co-ordinating the numerous specifications for material for carbon steel forgings now being worked to in Canada, and if possible establishing the characteristics of a comparatively small number of grades of steel which could be used to fill those specifications.

National Electric Code

It was decided to instruct a special committee, under the chairmanship of Mr. E. G. Burr, consulting engineer, Montreal, to proceed with an enquiry into the desirability and possibility of framing a Canadian National Electrical Code. It was pointed out that such a document, so far as hazard to life is concerned, has been drawn up in the United States under the auspices of the Bureau of Standards, while fire hazard has been dealt with by the rules of the National Board of Fire Underwriters. The sub-committee is to consider the measures to be taken should it be thought advisable to draft a Canadian code for covering these subjects for wide acceptance in the Dominion.

A communication was read from the council of the Engineering Institute of Canada requesting the association to deal with a number of the specifications of the Institute, considering and revising them if necessary, as has already been done in the case of the specification for steel railway bridges. It was decided to take up first the Engineering Institute of Canada's specifications for steel highway bridges and for cement, and to organize suitable committees to report upon them.

Aircraft Standards

It was announced that the Air Board has approved of the Canadian Engineering Standards Association, through its sectional committee on aircraft parts, as the body through which Canada is to be represented on the International Aircraft Standards Commission. This action was welcomed by the committee and it was pointed out that the approval of the Air Board gave official recognition to the work which has al-

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Canada's Engineers—J. M. Oxley

Mr. J. Morrow Oxley, well known Toronto structural engineer, was born in Halifax, N. S., in 1883 and was educated at the Montreal High School and the University of Toronto. In 1901 he was with the Dominion Bridge Company as draftsman, in 1902 joining the Canada Foundry Company in the same capacity. In 1905 and 1906 he was assistant engineer in charge of the construction of the Aberdeen Grain Elevator for E. A. Bryan Company of Chicago and Midland, Ont. He then took up consulting structural engineering as member of the firm of Oxley & Chadwick, Toronto, carrying out the structural design of a number of buildings in Toronto and elsewhere, including the Robert Simpson store, extensions to Christie Brown factory, Toronto Observatory, new shops for Midland Engine Works, etc., etc. In 1909 Mr. Oxley became chief engineer for McGregor & McIntyre, structural steel contractors, in charge of the design and drafting departments, and in 1911 he became a member of the firm of Harkness & Oxley, consulting engineers, Toronto. This firm has been engaged on the structural design of many of Toronto's notable buildings, such as C. P. R. office building, Dominion Bank head office, Central Y.M.C.A., Knox College, Methodist Book & Publishing House, Eaton Memorial Church, etc., and as engineers in charge of design and construction of industrial plants, such as the John Inglis boiler shop, Toronto; Brown Copper & Brass Rolling Mills at New Toronto; National Fireproofing Co.'s plant, Waterdown, etc., etc.

Mr. Oxley went on service with the C. E. F. in 1915, first with the 95th battalion, then as supernumerary, company commander and second in command of the 124th battalion Pioneers in France, then with the 12th battalion Canadian Engineers. He was transferred to the reserve with rank of Major in December, 1918.

From March, 1919, he has been a member of the firm of Chapman, Oxley & Bishop, architects and engineers, Harbor Commission building, Toronto. Mr. Oxley is an associate member of the Engineering Institute of Canada and is now acting as chairman of the committee of the Toronto Branch, appointed to review the proposed new building by-law for the city of Toronto.

Mr. J. Morrow Oxley

ready been accomplished by Canadian representatives at meetings of the Commission.

The International Aircraft Standards Commission was organized in 1917, primarily as a war measure, with the object of obtaining, as far as may be, international agreement regarding materials for aircraft as well as details of aircraft construction and equipment. It is, for example, obviously desirable that aero engine magnetos made in different countries should be built within certain limits of overall dimensions and should conform to general specifications which would enable a French magneto to be used in an emergency on a British machine finding itself in difficulties in France. The Commission has already made gratifying progress, although it is unfortunate that the United States has so far been unable to appoint a committee to take part in its work. The countries now active on the Commission are Great Britain, France, Italy and Canada.

A grant of £200 towards the funds of the Association was announced from the British Engineering Standards Association and the secretary reported that he now had in stock a supply of almost all the publications of the B.E.S.A.

A communication was read from the American Engineering Standards Committee, advising that in the opinion of the A. E. S. C. co-operation between that body and the C. E. S. A. should be provided for by the interchange of minutes of the meetings of the respective main committees, so that joint action could be arranged for, wherever necessary. The committee heartily concurred in this suggestion, which will be adopted in future, and the hope was expressed that many opportunities for co-operation would present themselves.

Error in Irrigation Article

In an article on page 244 of our march 17 issue, entitled "Determination of Lateral Capacities to Supply Irrigation Requirements" an error, which may prove misleading, crept into the second paragraph. This states "the Government requirements under which water rght applications are made require water to be delivered, etc." This should have read, "were made," as the conditions set forth in the article are at the present time entirely in accord with the government regulations. It might appear from the article that the capacities of the ditches were not determined in a manner agreeable to the government conditions. The correction is, therefore, noted herewith in order that there may be no misapprehension in this regard.

At a meeting of the Ottawa School Board held on April 20 it was decided to withdraw all advertisements for tenders on the York Street School until the present labor disputes are settled.

Tractors for Haulage are Money Savers

More Work at Less Cost Has Been British Columbia's Experience According to Paper Read Before Provincial District Engineers

By Arthur Dixon*

WHILE there is no doubt that the tractor is fast replacing teams for both farming and construction purposes, the practicability of their use is, I think, still in the experimental stage, as far as the latter is concerned. Early in the season I took the subject up with the Good Roads' Board of the Province of Manitoba, and the following is an extract from the reply received from the chief engineer:

"Re use of tractors in road work, I beg to state that so far, we have had actual experience with only one type of tractor, a 40/60 'Twin City,' which was owned and used by the municipality of Portage la Prairie, under the supervision of our engineer. This engine was used in pulling two twelve foot blade Russell graders. It proved very satisfactory, but was hardly strong enough to handle the two graders and for the coming season it is proposed to get either a 60/80 'Twin City' in place of the present one, or keep the present one and buy a lighter engine for pushing it. Probably the last named course will be followed."

A type of tractor used for road work in British Columbia

The Province of Saskatchewan, Department of Highways, advised through its superintendent:

"In many instances through this Province, tractors have been used for hauling and operating machinery on road work and have proven to be both satisfactory and economical in operation.

The weight of the tractor used determines the amount of work it should be called upon to do in order to reduce the cost to a minimum, as for instance, a heavy tractor could satisfactorily be used in hauling two graders, a heavy one to do the actual grading, and a light one following, which would push the dirt to the crown of the road and do a certain amount of smoothing work.

"In addition to the actual grading operation, the tractor is also very useful in compacting the road surface, and in this connection we feel that the type of tractor with the widest possible width of tire would be the most suitable, as it would give a smoother finish than the narrower tires.

"We have no definite information in the way of actual figures to show the economy of using the tractor in preference to teams, but we know that the steadiness of pull and the fact that the work is more continuous has warranted the use of the tractor in this connection in quite a general way."

The Alberta Provincial Department of Public Works replied briefly, as follows.

"It is rather difficult for us to give you anything definite at the present time. We tried out a few tractors with heavy graders last season, but did not do enough work with them to arrive at any conclusion as to where the best results were obtained."

Saving Over Horses

The majority of tractors at present so largely advertised are no doubt designed principally for farming operations, although several makes of all sizes and types have and are being tried out for construction purposes of various classes, and I think I am safe in saying a great saving has usually been found as compared with horses. There are cases, however, where it is practically impossible to replace teams on road work, but it would seem most advisable to reduce their number to the minimum where economy can be shown.

One has only to look over the recent numbers of engineering and contracting periodicals to note the numerous short articles concerning experiments with tractors, on the different classes of construction work. The following instance is taken from a late issue of "Successful Methods," the tractor referred to being a small Cleveland "Caterpillar."

"The William Dunbar Company, of Cleveland, Ohio, contractors, have been experimenting successfully with a small 12 horse-power tractor in connection with wheeled scraper and wagon hauling. This concern had a 12-ft. cellar to excavate, and found that by hauling a single-wheeled scraper by tractor, as much dirt could be removed as with 3 team-drawn wheeled scrapers and a deeper cut would be made. Part of the excavation material was taken out by team-drawn dump wagons, and a tractor was used in place of snap teams for helping the load out of the pit. A gallon of gasoline was consumed per hour."

More Work at Less Cost

Unfortunately no costs are given. However, there is sufficient evidence to show that a great deal of attention is being given generally at this time to the introduction of tractors as labor-saving devices. The question is of vital importance to us in British Columbia, where we are perhaps differently situated from the other provinces of the Dominion, both geographically and, may I say, financially. With the tremendous mileage of roads which the province has to maintain, to say nothing of the requirements of the future, every possible dollar should be turned into output if a successful road building programme is to be maintained. To get down to the use of tractors, in a general way, I have found that they are able, when handled by competent drivers, and under favorable conditions, to do practically anything a team is capable of doing, and do more work at much less cost.

All comparisons given are made under the very best conditions, because I believe, when the "Wallis" or any other tractor of the same type falls down, a "caterpillar" will do the work.

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*District Engineer.

To begin with, a brief description of the "Wallis" machine will not be out of place, with a few references to its advantages and disadvantages. It was the type we tried out this past year. This tractor has a draw bar pull of 14 horse power, is of the round wheel type, with a single wheel in front for steering, and weighs approximately 3,500 pounds. For an engine rated at this horse power, I find that the tractor is capable, under certain conditions, of greater pulling capacity than at first anticipated. In short, the engine has been very satisfactory.

In order to give extra traction, large iron knobs or "spuds" as they are termed, are provided to be attached to the rear wheels—28 in each. Without these it was found impracticable to operate the tractor, even with a small load. Recently a set of angle irons, or "grousers" have been furnished, which are reported by the manufacturers to be more satisfactory than the old type, evidently referring to the "spuds." This may, or may not be the case, as to date we have not had an opportunity to try them out, so that no actual comparison can be given.

The splendid engine, and the simplicity of construction are two good points in this tractor's favor, but I have found that it has several disadvantages. First, while it is practically impossible to stall the engine, there is apparently not enough weight in the tractor itself to give the traction required to climb gravel pitches of 5 per cent. to 7 per cent. with a load, say a dump wagon of gravel. The revolving wheels simply tear out the gravel which will not only spoil the road, but causes a vibration sufficient to ruin the machine in a very short time.

Working in sandy material with a grader, the machine will do the same thing, having to be frequently dug out, causing a loss of time. While operating a grader in wet weather in gumbo material, the wheels were also found to skid so much as to tear out the material, causing the tractor to settle into the mud as far as the frame allows, practically to the axle. In such cases we had to call for an extra man to keep the wheels from clogging. The latter trouble is really responsible for the skidding above mentioned, and we are unfortunately subject to much wet weather in northern British Columbia, and have many miles of gumbo roads to maintain.

These disadvantages are common to all round wheel tractors, so that the "Wallis" cannot be taken as an exception. The single steering wheel is too light to stand the constant strain of heavy work—it was found necessary to add re-inforcements—also the front fork casting was latterly broken. The two-wheel steering system is very necessary for operating this tractor on road work—the single wheel may be all right on the farm.

The work carried out this year with the tractor has principally consisted of ploughing, grading and in a few cases, of hauling material. In ploughing the tractor was equipped with a large 4-horse breaking plough, and averaged at the rate of 24 round trips of ½ mile per day of 8 hours, or 12 miles, which is approximately equal to two acres. The operating expenses were:

Rental and depreciation of tractor	$5.00
Gasoline, 8 gallons at .45	3.60
Engineer's wages	5.00
1 man at $4.25 and 1 man at $4.00	8.25
Oil, grease and waste	1.00
Total	$22.85

or $11.42 per acre.

Four horses could not begin to do this amount of ploughing in a day; indeed, an acre in a similar class of material would be considered a very big 8 hour day's work. Even putting it at this the cost would be:

4 horses at $2.25	$9.00
1 driver	4.25
1 ploughman	4.00
1 extra man	4.00
Total	$21.25

or $21.25 per acre.

I may state that there were instances where ploughing was found to cost more with the tractor, than that stated above, due to changed conditions in material, heavier roots to be taken out, etc., but this would not alter the proportionate cost.

In heavy grading, I regret that no correct details are available, but the tractor will accomplish two to three times more work than a six horse team and grader. One case: A short piece of grading in hard silt about a quarter of a mile long was completed without ploughing in six hours with the tractor. With teams it would have been necessary to use the plough, and have taken a good day's work to finish.

The costs are as follows:

By Tractor

Rental and depreciation of tractor 6 hours	$3.75
Gasoline	2.70
Driver's wages	3.75
Grader man	3.87
Extra man	3.00
Total	$17.07

By team of six horses

6 horses at $2.25	$13.50
1 driver	4.25
1 grader man	4.25
1 extra man	4.00
Total	$26.00

The tractor will easily travel with heavy grader, camp outfit, and supplies on wagon, and water tank, making 30 miles per day, or the same work as three good teams, with a saving over the team work of $10.00. The same applies to hauling hay, grain, lumber, etc. The tractor is capable of doing about three times as much as a team, and show a saving, thereby proving the following statement: A horse is capable of continuous pull of one-tenth its own weight; a tractor of this size has a draw bar pull at 2½ miles per hour of 1,300 pounds or approximately one-third of its weight. It is this greater pulling capacity, together with its ability to keep it up for 24 hours per day if necessary, that makes the tractor produce power at a lower cost than horses.

Desirable Types

There are so many places where the round wheel tractor cannot work, particularly, those previously mentioned. This causes a lot of delay, lost time, and unnecessary expense. In very wet places it has been found essential to even lay temporary corduroy down to get the tractor over. I am, therefore, of the opinion that the caterpillar type would give more all round satisfaction, work a longer season, and possibly give greater output. Of course, the initial expense of this class of tractor is greater, but there is no doubt that the saving would pay any difference in one season's work.

Another question to consider is the amount of work to be done in the year, and whether such an expensive piece of equipment could be kept busy a sufficiently long time to warrant its purchase. Some of the districts are unfortunately so badly disconnected as to make interchange of large machinery a difficult and expensive question, although there is no doubt that in other parts of the province such a system could be economically worked out.

The use of tractors on road work will no doubt be made a big success in the future, but before any large purchase of standard equipment is made at the present time, the matter should be thoroughly discussed by all concerned, as I do not think any one type would be generally suitable. A good mechanic should always be put in charge of a tractor, whether large or small, and I believe that where two or three machines are in use a permanent man should be kept, so that in the winter repairs and overhauling could be attended to. This man could also do most of the overhauling of all government cars in the district.

Where a Contractor Loses His Profits

Enforcement of Some of Innocent Looking Clauses Commonly in Contracts Would Work Unfairly Against Contractor

By Royal A. Stone*

In one contract that we opened some time ago, we found in the specifications, and very deep in the specifications, sunk 'way down in the fine print towards the end, the following paragraph:

> Any omission to disapprove of the work of the engineer at the time of the monthly or other estimate being made, shall not be construed to be an acceptance of any defective work, etc.

You are all familiar with those general clauses in the contract. As I have indicated the draughtsman of the particular contract went just as far as possible to confuse—he may not have intended to, but that was the result—so that the careless contractor might very easily be led into signing that contract without actually knowing what was in it. Thousands and thousands of such contracts have been signed by parties who knew what was in them.

I am going back to that first paragraph that I just read, because it is objectionable from another standpoint. Consider it again for a moment. This work must necessarily be done pursuant to the designs and under the direction of the engineer; but tell me, if an engineer comes along with a piece of railroad work or drainage canal and sees that the piece of work is being done improperly, that the structure is contrary to the specifications, that it is inherently weak, has he any right to pass it up, and in six months hence, after you have gone and after the outfit is moved somewhere else, to spring this specification and say, "You have got to go back and do it all over again"?

I think that a fair provision would be along this line:

"The failure of the engineer to disapprove in writing of any work claimed to be defective, as soon as the alleged defects are discovered or in the exercise of reasonable diligence shall be discovered by him, shall be deemed an acceptance of the work in question."

This is the rule which would be applied in court were it not for the contrary controlling provision of the contract.

Extra Work

Here is another very common provision, and in substance, a necessary provision:

> The engineer may * * * * order extra work to be done or make any changes he may deem expedient * * * * and may furnish other plans. * * * * All such extras and changes must be directed by the engineer in writing, who shall fix the amount by which the cost of the work is increased or diminished. * * * * Claims must be made monthly and * * * * shall only be allowed when the engineer has in writing authorized same and stated the prices to be paid therefor.

In substance, that is a necessary provision. It is the result of experience, but knowing that all of the professions must be fallible, I think it is altogether too much power to grant the engineer. "He may furnish other plans;" he may change the whole scheme of the work, change the location, and absolutely disorganize the plans of the contractor. He may do it at any time after you have your outfit placed and after your work is started, and those provisions are the only convenant; and the other clause denies you any recovery for any loss of anticipated profits by reason of any such change.

Contractor's Time and Expense Must Be Paid For

I do not think the engineer ought to have a right so to change the plans that the entire nature of the work, from the contractor's standpoint, is changed. The contractor should have a right to elect—"I will go on with the work and perform the contract under your price, or I am through. You will pay me for my expense and loss of time." I think that would be a reasonable way to take care of a situation of that kind.

It is understood that in the event an engineer orders changes and extra work, the price fixed by the engineer must be a reasonable price. I think the contract ought to be so worded as to protect the contractor as to that phase of the question.

Now, to illustrate just what happens when two engineers fix the price. I was out on a trip recently in connection with a project under construction, and the engineer for the public fixed the price of raising a piece of industrial track just a few hundred feet at $5,000, and the engineer for the railroad company fixed the price at $12,000. In a situation of that kind the contractor ought to be protected and it ought to be left for him to say whether he will go ahead or quit, and if he elects to quit, he ought to be paid for what he has already done.

The Weakness of Waiving Contract Provisions

If you are bound by such a contract you have a right, in case of any such change, to get that amount fixed in writing before you proceed. Sometimes I hope to find the case of a contract where a contractor who, when such provisions are in the contract, will insist on having in writing that which he is entitled to have in writing. So far such cases have been very few and far between. You have relied on the good faith of the engineer, but the trouble is, despite the best efforts of the engineer, despite his honesty, notwithstanding your own good faith, and your own constant efforts to complete your contract, you may get into court. That contract comes to a lawyer; he picks it up; he is there to protect the rights of his client, and his client may be the owner. The owner has the right under such a provision, before becoming bound by any charge for extras, to have it fixed in writing. The lawyer says at once, "Why, you are not liable for this. The matter was not determined by written decision of the engineer before he went ahead with the work."

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*Excerpts from an address presented at the Annual Convention of the Northwestern Association of General Contractors.

There can be no recourse. What is the alternative for the contractor? This may represent the entire profit on the job, and that item may be the difference between future prosperity and temporary ruin—financial embarrassment. He can prove—he may attempt to prove—that that and other provisions of the contract have been waived. You can get away with it, ordinarily, but it is a costly proceeding.

Judge Caldwell, long on the Circuit Court of this district (St. Paul), once said in an insurance case. "Give me a policy and a fire and I will do the rest." Given provisions of this kind, given extra work, and ordinarily, the jury can be relied upon to do the rest.

When you are entitled to have anything in writing be sure that you get it and get it when you are entitled to it. It is an easy thing to overlook in the rush and press of work, but remember that the work is being done under a contract binding upon yourself, under written language which will be interpreted in the end by somebody other than you and the other contracting party who adopted it, so check yourself up as you go along with the work and get that to which you are entitled.

Who Hires and Fires Your Foreman?

Another provision happens to accompany this:

> The contractor shall keep a competent foreman * * * * to be engaged and retained only with the approval of the engineer.

I do not think such a provision ought to be allowed in any contract because they are generally provisions which protect the owner. To give the engineer, in the ordinary case, power to discharge your foreman and select another one for you is taking the work out of your hands to such an extent as none wants to consent to in advance.

When Extra Work is Done for Nothing

Here is another one along the lines of extra work. I said I was not going to criticize these provisions, but just give you the facts concerning them. One reason I am not going to criticize some of them is, I am trying to avoid profanity these days.

> All claims for extra work or material must be presented to the engineer for allowance at the end of the month.

So far so good. The owner has a right to demand that. The engineer is entitled to it. It is a matter of fair dealing between man and man.

> * * * * in which the same shall have be done or furnished, and shall, if allowed by the engineer, be included in the estimate for that amount; otherwise all claim therefor shall be deemed to be absolutely waived by the contractor.

In other words, mere omission by your superintendent may cause you a loss beyond the power of your engineer to rectify, because your engineer cannot change this contract. If the engineer wants to put that in the estimate a couple of months hence, he will have trouble doing it against the efforts of the lawyer and the court, if the matter finally gets into court. Again, of course, you have the recourse of the waiver of provisions of that kind, but it is a dangerous recourse. It is an attempt to cure where prevention should have been used.

And right along this same line, read this:

> Every allowance * * * * shall be embraced in * * * * monthly estimates; but should the contractor have a claim which he considers is not included in any progress certificate, it will be necessary for him to make such claim in writing to the engineer within thirty days. * * * *

That is far enough, but read this:

> Unless such claims are thus made and are repeated in writing every month until finally adjusted or rejected, the contractor shall have no recourse against the company.

How many contractors have signed that contract? It has been very common. No owner's or company's protective provision is more common.

When Delay May Be Costly

Study this:

> The only recourse of the contractor in case of delay caused by the company is an extension of time for a period equal to the delay, and the right of the contractor to such extension shall be deemed to have been waived unless a claim therefor, stating the occasion and nature thereof, shall be made by him in writing, delivered to the company at the time of such stoppage or delay.

Another:

> If there be any delay in the work, upon the written directions of the company, or by reason of any cause for which the company is held responsibe, the contractor shall have no claim for damage by reason of such delay, but the time specified for completing the work shall be extended for a period of time equal to the time of such stoppage or delay.

Notice the requirements, not originally, but as the work proceeds along:

> The contractor shall be at the risk of, and shall bear all loss or damage whatsoever, and howsoever arising, which may occur to the work, until the same has been accepted by the company, and all damage occurring before acceptance shall be made good by the contractor.

That is, if you complete a piece of grade or any other work, although it is done so far as you are concerned, and the company delays you, causing you to lay up during the winter season, during the season of heavy rains, during the season of the greatest activity of disintegrating frost in the spring, through no fault of your own, the engineer has the right and it is his duty under that contract, to make you go back and do the finishing work over again, a very, very costly proceeding in some cases. Under such a provision an engineer by wilfully delaying acceptance of the work, may impose upon the contractor, not only a risk of damage but a very, very certain conclusion that you are going to be damaged to an extent far beyond your profits.

This Clause Puts Lien on Entire Outfit

Here is a provision that is unusual, with which you may disagree, because you may have seen it more than I have:

> All machinery and plant provided for the work shall * * * * become and, until completion of the work, remain, the property of the company, for the purpose of said work, and shall not be removed or be disposed of other than for said work. without the consent in writing of the engineer Provided, however, that upon completion of the work and upon payment by contractor of all moneys due from him to the company, such of the machinery, plant, and materials as shall not have been converted in the works and remain

unindisposed of, may be removed by the contractor, at his own expense.

In other words, the builder, in that case the owner, or company, makes you give him a lien upon your entire outfit for the security, first, of your execution of the work, and, second, for the security of any sum which you owe the company for the privilege of working for him. What is the effect of such a provision? I do not believe it is equitable. I do not believe that the sense of the contractors of the Northwest—I do not mean that as a question of the good sense of your combined judgment—is going to tolerate the continuation, if it is being used, of the use of that provision.

Getting the Contractor Going and Coming

And here is the supreme limit in the way of language of some general counsel somewhere—I won't tell where—I happen to remember the contractor myself—in the way of inserting into a contract a provision unquestionably unfair, absolutely damnable in the injustice of the uses to which it may be put.

> Delivery to the company, if required, of a valid release of all claims in respect to matters connected with or arising out of this agreement; the furnishing of such certificate, evidence and release being a condition precedent to the right of the contractor to receive payment in respect of the final estimate:

In other words, if you get to the fighting point and want to sue on account of the work you have done, before you sue you have got to acknowledge receipt of payment of that work. That is what it amounts to, and that, more than anything, is a good illustration of the extent to which gentlemen of my profession, working for only one side of an interested group, as they should—for lawyers cannot serve two masters any better than anyone else—that is an illustration of the extent to which that system goes. The remedy is for these contracts to be drawn as other contracts are drawn, so as to represent the combined judgment of the owner on the one side and the contractor on the other, as to what is fair concerning the work to be accomplished.

How to Obtain Fair Contracts

Hereafter, that sort of contract can be worked out by this organization by your joining forces. It is certainly within your power to compel the elimination from the contracts under which you must proceed, of any such provision as that. If that contract is drawn by one party, of course, it represents the interest of that party, whether he is the owner or the contractor, and the general conclusion, the general recommendation to which I want to call your attention, is that hereafter contractors owe it to themselves to see that the contracts under which they execute their works represent their ideas as well as those of the owner.

Proposed International Highway Bridge Across St. John River

Structure Comprising Four Spans of 235 ft. Each to be Erected Between Edmundston, N.B., and Madawaska, Me.

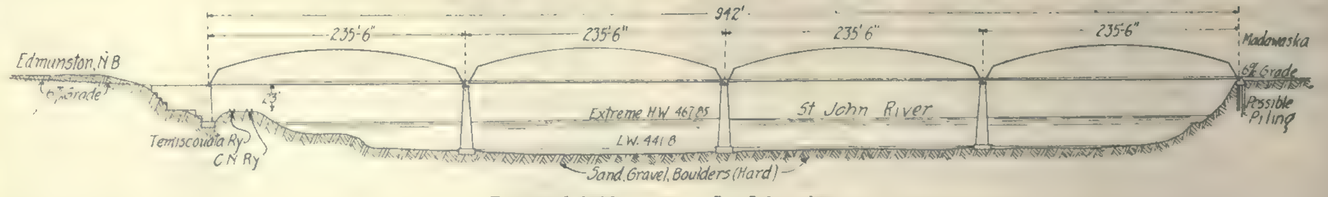
By A. Langlois, B.A.Sc., C.E.

FOR several years the residents of Edmundston, N. B., and Madawaska, Maine, have been asking their respective governments for a highway communication between the two shores of the St. John River at that point. For excellent reasons, however, the undertaking has been delayed, but at the last session of both the State of Maine legislature, and the Canadian parliament the necessary appropriations were voted and the construction of the bridge will be commenced this present season, the plans being now ready.

The proposed bridge will be built under the supervision of the State of Maine Highway Commission, jointly with the Department of Public Works of Canada. The Maine Commission, of which Mr. P. D. Sargent is the chief engineer, will have charge of the superstructure, and Mr. S. J. Chapleau, district engineer of the Department of Public Works, will have charge of the substructure.

The sketch below shows the profile of the proposed bridge and of the river. The cost of the work will be about $252,000. The total length of the bridge will be 942 feet. The superstructure will comprise four spans of 235 ft. each, resting on five concrete piers and abutments.

The St. John River is not navigable at Edmundston. The water rises to a great height during the spring season, receding to a very low level in the summer, the variation between high and low water being 23 feet. The flow passing at that section varies from 1000 to 134,000 cubic feet per second. In the high water period the river passes a great mass of timber which, with the large flow of water, had to be reckoned with in the design of the bridge. There are three railroads going through Edmundston, the Canadian Pacific, the Temiscouata and the Transcontinental Railways. There is one railroad on the U. S. side of the river.



Proposed bridge across St. John river

Motor Fees in Nova Scotia Form Basis of Fund for Road Improvement

Provincial Highways Board Make Recommendations with Regard to Disposal of Income from Motor Car Licenses

IN the report of the Provincial Highways Board of Nova Scotia, some recommendations are made with regard to the disposal of motor car license fees and their use for highway improvement. The report states:

During the past season a census of the highways traffic was begun on the more heavily travelled roads of the different counties. When completed, the results, will be worthy of study. If, as seems probable, the registration of motor vehicles should double within the next three or four years, this province has a most serious problem on its hands. In the opinion of the Board the license fees, though increased last year, are not yet at a figure high enough to make good the damage done the roads by this class of traffic. The prosecution of offences against the Motor Vehicle Act, such as excessive speeding, etc., has not been committed to the Highways Board, but it is vitally interested in this matter. Large areas of the province are wholly without police protection, and some body or authority should be definitely charged with this duty.

The increase of motor truck traffic on the roads is most pronounced. The provisions of the Weight of Vehicles Act should be enforced. None of the roads can withstand the larger trucks, the rolling weight of which exceeds twelve and thirteen tons; nor has the Board any funds to attempt the construction of roads to carry this traffic.

The Board would urge the passage of an Act to regulate and make uniform throughout the Province vehicular and motor traffic. Provisions as to such traffic are scattered through different statutes, and it is desirable to have these laws consolidated and made applicable to present day conditions. It is also suggested that the registration of motor vehicles and the enforcement of the traffic laws might properly be committed to the Board.

The Board regrets to observe the beginning of an agitation to divert the motor vehicle fees from the Provincial Treasury to the cities and towns where the licensee lives.

Cities Not To Get Fees

The increasing revenue from this source offers the only fund upon which large borrowings can be based, and to refund the whole or any part of it to the cities and towns will simply defeat the whole good roads movement. Adopting the arguments of the Ontario Deputy Minister of Highways to conditions in Nova Scotia, we urge:—

1. "The registration of motor cars is necessarily a function of the provincial government, since for purposes of law enforcement it is essential that all cars be registered in a central department. The province thus relieves municipalities from the responsibility and expense of registration, and the registration fees are primarily indicated as a source of provincial revenue.

2. "By the legislation of 1913 a portion of the motor revenue was specifically appropriated for expenditure on the great provincial roads. In 1918, the fees were advanced in order that a substantial fund might be created for road improvement; on the strength of this advance, $500,000 has been borrowed for improvement, and payment of interest and principal of this debt has been made chargeable to the motor revenues.

3. "As the motor revenue increases there is the probability of further substantial sums being borrowed thereon. Indeed the ability of this province to undertake a forward movement for the improvement of the roads depends in keeping these revenues as provincial, not municipal.

4. "Motorists are relying on the law of 1913, and on the implied promise made when the motor fees were increased, that the purpose was to provide for road betterment. It is incumbent, therefore, for the provincial authorities to see that this money is applied to substantial road improvement, and not returned to local municipalities to enable them to reduce the local tax rate.

5. "The road laws have been placed on their present broad basis in the belief that revenue from motor vehicle licenses would form a permanent fund for road improvement. If this revenue is to be lessened, provincial expenditure on roads will be necessarily decreased.

6. "The use of the motor car is not confined to the municipality in which it is owned. The result is that cars owned in the cities and towns of the province are used freely on all the rural roads, and the demand for the improvement of the rural roads is as urgent from the cities and towns as from any other quarter.

7. "If motor car fees were returned to the place where the car is owned, then the money so received from the cities and towns would be returned to them, and would be unavailable for use on the country roads, the improvement of which as previously stated, is largely urged by the residents of these cities and towns. Cities and towns should contribute to the construction of the provincial roads. This is done directly or indirectly by every country which has built up an adequate system of roads. So far as Nova Scotia is concerned it can be done in no other way.

8. The great need in Nova Scotia, and it is the basis of the Highway Act, is concentration of funds for highways work.

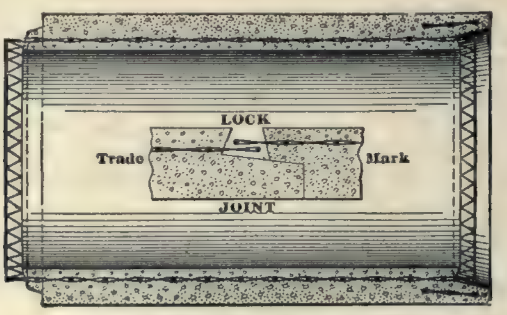
9. "Briefly, roads must be built in proportion to the traffic over them. Roads of heaviest traffic are those radiating from shire towns and shipping points, or roads connecting the cities and towns of the province. These are the roads of concentrated motor traffic, and the roads expensive to build and maintain. Any system which results in diffusion of the motor revenue and lessens the funds available for roads of this character would defeat a fundamental need of the province."

Concrete Pipes Being More Widely Adopted

Paper Read Before Toronto Branch, E.I.C., Outlines Features of Lock Joint, Bonna and McCracken Types

By H. P. Heywood*

IN the following article a description of a few of the various makes of concrete pipes in use today, will be given with the idea of indicating the suitability of concrete for the many kinds of pipes used in sewer and water mains. The Lock Joint pipe, brought to its present state of efficiency by the Lock Joint Pipe Company, of New York, will first be dealt with. The original pipe was designed for sewer use in 4 ft. lengths, to overcome various obstacles and objections to the plain monolithic concrete sewer. This was at Wilmington, Delaware, in 1908. It was found that the work proceeded more rapidly and that the excavation cost was considerably reduced owing to the fact that the pipe could be laid right up to the excavation. This meant that quite a proportion of the lower and more expensively handled dirt could be thrown back on the pipe without damaging the joints. The sheet piling could be pulled and the trench back filled at the end of the day's work, thereby considerably reducing that well-known, and often abused item, "engineering contingencies."



The lock joint type of pipe

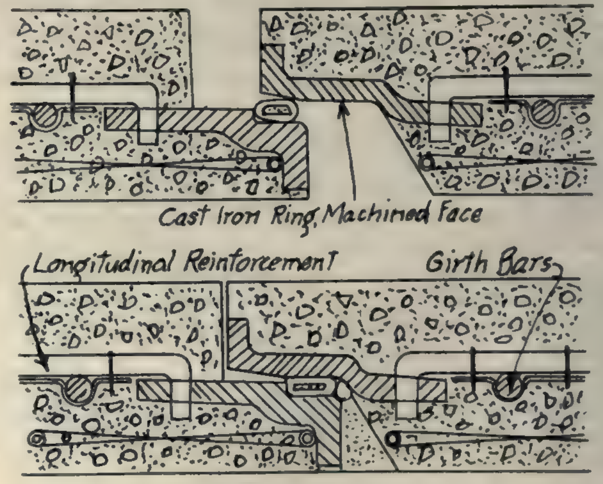
The Lock Joint

Lock joint pipes are made in sizes from 15 in. to 90 in. with variations of 3 in. up to the 72 in. size. Above that are 6 in. variations. They are moulded vertically in well oiled steel forms, spigot end up. The reinforcement, usually triangular wire mesh, protrudes about 2 in. from each end of the pipe, and when the pipes are laid in position, this reinforcement overlaps in a recess formed in the interior of the joint, which is V-shaped, and formed by the spigot and bell ends of the pipe. A sealing form is then placed inside the pipe over this recess and 1:1 grout is poured through a hole broken in the crown of the bell. The steel and the grout form the "lock." Sewer pipes are usually made in 4 ft. lengths and branch connections moulded where specified. The reinforcement is concentric, with a double ring for the larger diameters.

Two kinds of pressure pipe are manufactured by this firm. For the smaller sizes up to 54 in. and 12 ft. lengths, cast iron machined bell and spigot rings are cast in the ends. A slightly flattened lead pipe, filled with lampwick, and having its ends soldered together to form a ring, is placed inside a groove and pressed against a shoulder of the casting, forming a reversed wedge inside the bell. When the tapered end of the spigot comes into contact with this lead gasket, it forces it rapidly against the shoulder of the bell and into the reverse wedge, with a pressure which increases as the tapered end increases. The pipe is forced home when the taper of the spigot has passed this gasket. This joint allows the spigot to move backwards and forwards on the lead gasket through the extremes of expansion and contraction without causing any leakage. The use of this joint was greatly appreciated by the American Reclamation Service. About 10 per cent. of the lead of any ordinary C. I. pipe joint is used, and if necessary, the pipes can be taken apart and the gasket used over again. The thickness of the walls varies from 3 in. to 5½ in. for the 54 in. diameter pipe.

Joint in Large Pressure Pipes

For the larger pressure pipes, ordinarily 8 ft. long, a copper expansion joint with a bead rolled into it is used. The joint is similar to the sewer joint, except that the triangular mesh reinforcement projects from the bell end only, while the copper strip and its rolled bead project from the spigot end, half the width of the strip being previously moulded into the pipe. The mesh and copper, therefore, overlap in the recess of the joint. The grout is poured as in the sewer pipe, and adheres to the copper and mesh, but is prevented by paint from adhering to the concrete spigot of the other pipe. When the temperature movement of the pipe occurs, the bead in the copper opens or closes without causing an opening in the joint. This joint was recently used in 10 miles of 66 in. diameter pipe for the Greater Winnipeg Water District. The head varied from 45 ft. to 95 ft. Leakage allowed was 118,000 gal. per day and when tested it did not exceed 43,000 gal. per day. Incidentally for the remainder of the 95-mile aqueduct, built in 45 ft. sections of



Typical pressure pipe with lead expansion joint; upper, position of gasket and pipe ends before placing pipe together; lower, finished joint the inverted horse shoe shape, a beaded copper strip was used at the joints with good success.

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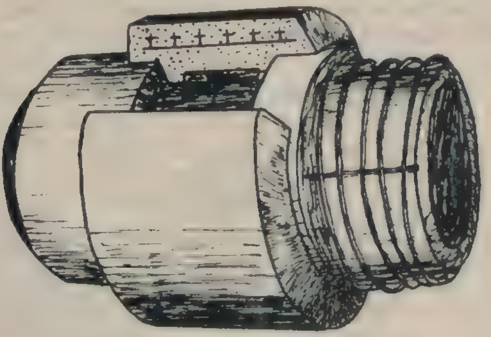
*Assistant Engineer, Toronto Harbor Commission.

A good type of subaqueous pipe, rigid and non-rigid, is also made by this firm. A modified type of the rigid pipe is very suitable for high-class caisson work and is made with a C. I. cutting edge at the bottom of the caisson. Sections 20 ft. long and joined together with C. I. flanges bolted on the inside of the caisson are used. These flanges are embedded in the concrete and held securely in position by bolts the length of the pipe which also act as longitudinal reinforcement. If a watertight caisson is needed a gasket is placed between the C. I. flanges. A similar type to this, 30 in. diameter, is very successfully made by one of the largest contracting firms in New York for underpinning work. In most of the above mentioned pipes the pouring is done with conical-shaped buckets filled with a ball valve at the bottom. The pipes are then placed under canvas and steamed for about four hours under ordinary weather conditions and allowed to set for twelve hours, then stripped and turned on their sides after three days and shipped after two weeks of final setting. This company is at present engaged in replacing several miles of wood stave pipes.



The Bonna type of concrete pipe

Leakage Is Low

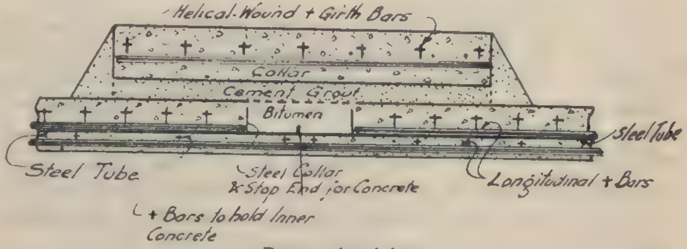
Leakage tests made at Baltimore in 1913 on 3,000 ft. of 84 in. and 5,000 ft. of 108 in. gave an actual leakage of 13,000 gal. per day against an allowable leakage of 38,000 gal. per day. Head used was 80 ft. Another test in Dallas in 1915 on 14,400 ft. of 36 in. pipe gave 17,000 gal. per day against an allowed leakage of 22,000 gal. The heads were 30 ft. and 80 ft. Another test in Fort Worth, Texas, the same year with the same length of pipe of only 48 in. diameter gave 15,000 gal. per day against 36,000 gals. per day allowed. The head was 20 ft. to 60 ft.

A test of the strength of the lock joint was made by placing 24,000 lbs. directly on the joint made by two pipes supported on two bearings 6 ft. c. to c. A deflection of only 1/16 in. was measured.

The Bonna Pipe

A few details of the Bonna system of reinforced concrete pipes manufacture will now be given. This type of pipe was invented by M. Aimee Bonna, Paris, and it is one of the very few concrete pipes now made which can successfully withstand the higher pressure. Consequently it is becoming increasingly popular in England. The chief feature is a mild steel tube 1 m.m. thick, built up from sheets of steel which are rolled to the required diameter in lengths from 9 to 12 ft. The longitudinal joint is butt-welded by the oxy-acetylene or electric process. The ends of the steel tube thus formed are turned up and welded to the adjoining edge of the next tube, thus forming a flexible expansion joint. A collar of the same material is then welded on, which forms a receptacle for the bitumen covering of the joint. The reinforcing steel is wound around a mandril in helical form to the required diameter. A heavy section is passed over the steel tube to resist the internal pressure and a lighter section inside the tube to hold the inner coating of cement in place.

The pipe is moulded vertically, using steel forms, and remains in this position four or five days, and is used after a month's duration. In laying the pipe the circumferential joints are welded, and bitumen is run over them and a collar of reinforced concrete is placed over all and the space between this and the pipe is run with cement mortar. This joint, unlike the Blair and Lock Joint pipes, necessitates jointing holes in the trench. In the case of high pressures the bends should be buttressed by concrete to resist the outward thrust of the water pressure.



Bonna pipe joint

This system was employed in Swansea fifteen years ago on a water main, 1,200 yds. long and 19.7 in. diameter, with a working head of 185 ft. On completion it was tested to 382 ft. and proved satisfactory. The longitudinal butt welded joints were also tested, with the following results: Strength of steel in tube, 21.35 tons per sq. in.; strength of butt welded joint, 21.5 tons per sq. in., the joint being slightly stronger than the sheet steel. Bends and specials are made by hand moulding instead of pouring. There has not been a single burst on this main since completion.

In 1909 Norwich City built 4,500 yds. of 36 in. sewage pumping main. The lowest tenders for delivering, laying, jointing and specials (exclusive excavation) were: Bonna pipe, $3.50 per ft.; steel pipe, $4.50; C. I. pipe, $6.50. The working head was 120 ft. and the city engineer, Mr. E. Collins, considers the main is quite safe now at 300 ft. head.

The McCracken type of pipe

Several other types of joints are used and include a gasket filled lead pipe driven into a steel corrugated ring. I will not go into any further details about this pipe as it is not yet manufactured in this country.

McCracken Corrugated Pipe

The last type I shall mention is a plain concrete sewer pipe, manufactured at Woodstock by the Independent Pipe Co., Ltd., called the McCracken pipe. This pipe is different from most plain concrete pipes in that the outer surface is corrugated, giving it an extra crushing strength. It is cast vertically in a patent machine. A belt driven vertical shaft revolves a number of packer wings slightly larger in diameter than the required inside diameter of the pipe. Immediately below the packer wings is a kind of piston called a packer head, which on revolving produces the smooth inner surface of the pipe. The strong centrifugal force exerted by the packer wings, packs the concrete hard against the corrugated outer mould or jacket. Below the packer head is the bell packer, which forms the bell of the pipe. All the packers revolve at the rate of 350 r.p.m.

The concrete is fed into the jacket of the pipe by passing, through a chute, from an endless chain of buckets. When more concrete is added, the packer head and wings are gradually raised until the top or spigot end of the pipe is completed. No inner form is used, as the concrete is so densely packed and of a semi-dry mix, that it perfectly retains its true shape.

When the pipe is made it is removed to a curing shed or kiln and the jacket removed. A system of sprinklers is operated in this kiln and a mixture of water and steam, at 70 deg. F., in the form of a very fine spray or mist is allowed to fill the kiln for 30 hours, thereby procuring perfect hydration of the cement. After two weeks the pipes are ready for shipment.

The McCracken pipe is made in sizes from 6 in. to 24 in. and has been used extensively in many local works, including storm sewers for Toronto Harbor Commission, and the cities of Guelph, Galt, Woodstock, Walkerville and London, etc. Also many English contracts have been supplied with this kind of pipe through McCracken machines installed there.

Strength and Absorbtion Tests

Very recent tests made on these pipes by the Canadian Testing and Inspection Co., Ltd., (Table 1) show that the requirements of the American Society for Testing Materials are more than complied with. To obtain the crushing strength, divide the total load by the barrel length and multiply the result by ten-sevenths, if a knife-edge test; if a sand test, multiply by one.

In the absorption test, (Table 2), a square piece of the broken pipe is used, about 12 in. to 20 in. square, and thoroughly dried in an oven at 230 deg. F., then weighed and soaked in water for 2 hours. The excess globules of water are wiped off and the piece again weighed. The difference in weight is expressed as a percentage. The tentative specification of 1918 of the American Society for Testing Materials is practically the same as the specifications used for vitrified pipe for many years in the United States.

All the pipe manufactured by the Independent Pipe Co., Ltd. is carefully inspected, both during and after manufacture, by the Canadian Testing and Inspection Co., and each length must bear their official stamp before shipment. This is a long stride towards overcoming the prejudice that engineers have against the use of concrete products in general. This prejudice, in the past, I am bound to admit, has been to a certain extent justified, due to carelessness in manufacture and lack of adequate inspection.

Table 1—Crushing Test on McCracken Pipe, by Canadian Inspection & Testing Co., Ltd.

Number of Samples Tested	Diameter Ins.	Length Ins.	Thickness Ins.	Capacity in Lbs. per Lin. Ft. (Average)	A.S.T.M. Requirements, Lbs. per Lin. Ft.
3	6	25	¾	2,477	1,430
2	6	30	⅞	2,570	1,430
3	10	30	1	2,440	1,570
2	12	30	1⅛ to 1¼	2,235	1,710
3	15	30	1½	2,338	1,960

Table 2—Absorption Test on McCracken Pipe, by Canadian Inspection & Testing Co., Ltd.

Diameter Ins.	Absorption	A.S.T.M. Requirements
6	4.6%	8%
8	4.6%	8%
10	3.9%	8%

Wider Adoption of Concrete Pipe

In conclusion, I must state that concrete has been used as a material for the construction of sewers for many years. Practically all cities have adopted its use for the construction of the larger diameter sewers. Its use for smaller diameter sewers has not been adopted so extensively, undoubtedly owing to the fact that there has been more or less doubt connected with all concrete products which have been placed on the market. This is due to the fact that until recent years there has never been a recognized standard specification for the manufacture of cement concrete sewer pipe, and also to the tendency of cement product manufacturers to overlook the fundamental principles recognized in all concrete work.

Within the past few years engineers have appreciated the value of concrete as a material for sewer pipe and have put forth every effort for the standardization of specifications and methods of manufacture. There are a number of instances on record where concrete sewer pipe has been in use for over twenty years, and wherever occasion has arisen to take up the pipe they have been found to be in excellent condition.

Decimal Coinage in Britain

The Royal Commission which has been enquiring into the question, has decided against the adoption of the decimal system of coinage by Great Britain. An alteration of the established system, it is pointed out, could not be made as an experiment. "In our opinion," the majority of the commissioners say, "a large part, including the least instructed portion of the community, reckons its income in terms of shillings and pence, and we are satisfied it is idle to expect that the public would accept the disturbance created by the interference of their habits and the basis of their established notions of value by a change for which they have expressed no desire, and which will not benefit them in so far as they keep accounts."

The idea of changing the Montreal building laws to allow the construction of buildings up to 16 storeys has not been given up. A petition bearing nearly 14,000 signatures, prepared by a committee of citizens, has been presented to the Administrative Commissioners requesting an alteration in the by-laws. There is a proposal to build a sixteen storey hotel, and the points in favor of the construction of the hotel are that it will yield a large revenue to the city, provide employment, and also give much needed accommodation. The commissioners had previously decided against altering the by-laws.

Present Reproduction Costs of Water Works

How Continuous Upward Trend of Material and Labor Prices Affects Appraisal Value and Cost of Rebuilding

ANYONE who has had occasion to purchase water works construction materials at reasonably frequent intervals in the past five years has been impressed with the almost continuous upward trend of prices for those materials, along with practically all other commodities. We all know, in a general way, that cast iron pipe, which, prior to the war, varied in price from $25 to $35 per ton, is now costing from $70 to $75 per ton; that brick, formerly $6.50 per thousand, now costs $14, and that labor, formerly plentiful and efficient at 20c per hour, is now getting from 40c to 45c per hour, and is less efficient than formerly. Probably few of us, however, have had occasion to investigate the effect of these increased unit costs upon the total cost of constructing or of reproducing complete works properties, and it is to throw some light on this question that this paper was prepared. It is by Mr. L. R. Howson and was read before the Illinois Section of the American Water Works Association.

Prior to the war, the most commonly used measure of value in appraising water works properties, was the estimated cost to rebuild or reproduction, using as a basis for the estimate of future prices the average of the prices which prevailed during, say, the five-year period prior to the date of valuation. Obviously, reproduction is a rebuilding process of the immediate future, and the prices used involve a forecast of future prices and construction conditions just as they do in all normal engineering construction; however, in normal times, prior to the war, materials fluctuated in a series of cycles, with a gradually rising trend, and a very good idea of the near future prices was therefore possible by a study of the prices of the five-year period preceding.

Reproduction Costs of the Future

Within the last five years, however, construction prices and conditions have changed, and the question now arises as to where the reproduction costs of the future will probably lie. On several recent boards of arbitration, selected to fix the value of water works properties, two estimated costs of reproduction have been made; one on a prewar basis of unit prices, and the second on the basis of present day prices, and the value reasoned from these limiting estimates.

There are few well-informed people who will contend that prewar prices will ever again prevail in our time, and, accordingly, a cost of reproduction, using prewar prices, represents in all probability a minimum measure of the value of the property.

Most appraisers are also of the opinion that the crest of prices has been nearly or quite reached, and that, beginning soon, there will be a slow and gradual recession in prices to some new level intermediate between prewar and the present. Accordingly, a reproduction estimate made, using the present price basis, represents approximately the maximum value of the property to those who hold this opinion.

In Table I, herewith, are shown the average prices of the more important water works construction materials which prevailed during each of the years from 1909 to the present. This table shows facts with which most of us are more or less familiar.

Table II shows the results of cost of reproduction estimates made for six water works properties during the past year on both the prewar and the present price basis, and illustrates the effect of the fluctuation in unit prices on the total cost of reproducing the property.

In the ordinary water works property from 50 to 75 per cent. of the total value lies in the distribution system, and, for this reason, we have shown in the fourth column of this table the relative proportion of the distribution system cost to the entire plant cost both based on prewar units. The distribution system materials have increased in relatively greater proportion than have other water works materials, and, accordingly, the greater the proportion which the distribution system is of the entire property the greater will be the cost of reproduction at present prices as compared to prewar prices.

The data in this table show that:

1st. For a property in which approximately 50 per cent. of the total value prior to the war was in the distribution system, the cost of reproduction at the pesent time would be approximately 75 per cent. above prewar.

2nd. For a property in which approximately 75 per cent. of the value was in the distribution system prior to the war, the present cost of reproduction would be approximately double that of the prewar.

Subsequent to the making of these reproduction estimates the costs of lumber, millwork and some other materials have risen which would tend to increase these percentages slightly.

In using reproduction estimates to reason out the valuation of utility properties, several fundamental

TABLE 1—AVERAGE PRICES FOR WATER WORKS MATERIALS, 1910-1920

Material	Years									
	1910	1911	1912	1913	1914	1915	1916	1917	1918	1919
Cast iron pipe 6 in. f. o. b. Chicago	$26.92	$24.11	$26.17	$26.83	$24.21	$24.54	$31.25	$54.90	$57.85	$57.97
6-in. valves	12.50	12.50	12.50	12.50	12.50	12.50	16.50	19.50	21.00	22.50
2-nozzle hydrants	25.00	25.00	25.00	25.00	25.00	25.00	34.50	41.50	49.50	49.50
⅝-in. empire meters	10.40	10.40	10.40	10.40	10.40	13.25	14.10	14.10	14.10	14.10
Cross compound pumps per M. G. Cap.	3000.00	2700.00	2500.00	2500.00	2500.00	2500.00	3300.00	7500.00	7500.00	7500.00
Lumber, dealer's price	26.00	26.00	26.00	26.00	24.00	28.00	28.00	40.00	43.00	58.00
Cement (net)	1.25	1.25	1.25	1.25	1.15	1.15	1.43	1.78	2.00	2.00
Brick (Chicago)	6.50	6.50	6.50	6.50	6.50	7.00	7.00	9.00	12.00	14.00
Steel bars	1¾c	1¾c	1¾c	2.1c	1.9c	1.9c	3.5c	6.4c	4½c	4c
Common labor, Central Illinois	20c	20c	22c	22c	22c	22c	25c	28c	35c	40c
Teams	40c	40c	40c	40c	45c	50c	60c	70c	75c	80c

TABLE II—COMPARATIVE PREWAR AND PRESENT REPRODUCTION COST OF WATER WORKS

					Costs of Reproduction			
Plant	Population Served	Tons of C. I. pipe per 1,000 population	Per cent. distribution system total cost to reproduce, prewar	Cost of pipe per ton	Prewar	Cost of pipe per ton	Present	Excess present over prewar
A	92,000	245	58½ %	$27.10	$3,700,000	$63.00	$6,400,000	73%
B	8,500	217	79 %	29.00	280,000	57.05	503,000	80%
C	10,000	286	61 %	28.00	264,000	55.00	444,000	68%
D	12,000	294	77 %	28.00	394,000	59.50	689,000	75%
E	25,000	170	66½ %	27.10	632,000	68.00	1,192,000	89%
F	25,000	179	46 %	27.50	761,000	52.80	1,242,000	63%

With pipe at present price percentages in last column would be raised to 78 per cent. for A, 91 per cent. for B, 87 per cent. for C, 86 per cent. for D, 91 per cent. for E, 74 per cent. for F.

requirements must be complied with. Among them are:

1st. The kind of service afforded by the utility must be needed by the public in the future.

2nd. The utility being valued must be capable of supplying the service desired, economically, for the present, and be capable of economical enlargement to supply for the future.

3rd. The service must be supplied by the utility at a lower cost than that at which the individual could supply himself with equivalent service.

4th. The public need for the utility in the near future must be a stationary or increasing demand, and not a decreasing one.

When these fundamental conditions are satisfied, a cost of reproduction estimate, carefully made, using the reproduction conditions and prices which will probably prevail during the period of rebuilding and as well continued over a reasonable future period for which the rates are to be in practicable effect, furnishes the best index or measure of the future value of the property and it is to be noticed that it is the future value that we want to know. There is undoubtedly much difference of opinion as to just where the prices of the next few years will fall; however, there cannot be much disagreement with the statement that they will lie somewhere between the prewar normal and the present prices, and the consensus of opinion seems to be that they will lie closer to the present prices than the prewar prices for a considerable time to come.

Motor Trucks for Road Improvement Purposes

Experiences in British Columbia with Truck for Gravelling are Described at Convention of Provincial District Engineers

By G. B. Whitehead*

IN taking up the question of trucks, we first must go into the question of the work to which they are to be put. In the ordinary work, under the Department of Public Works, trucks should be divided into two classes: first, general purpose trucks; second, trucks for gravelling main highways.

In the first instance, while we have not been fortunate enough to have a general purpose truck in Engineering District No. 3, I have had the opportunity of watching a Chevrolet truck over a running period of ten thousand miles. This truck which cost complete $1,925, was used in a district noted for its bad roads; it was loaded on a fourteen mile turn road as heavy as 5600 lbs. with an average load of 4400 lbs., and it took a two-ton load up a 15 per cent. grade and brought in a gross revenue to its owner of $60 per day.

Uses of Trucks

A truck of this type with an auxiliary 1½ yard hand hoist gravel box should be stationed in each district and used for the following purposes:

(1) Hauling supplies to camps.
(2) Hauling bridge and culvert material.
(3) Repair work on by-roads in outlying districts.
(4) Hauling road drags.

There may be many other trucks of the same type that would do the work as well; but this truck in particular appealed to me as one that would do general purpose work without tying up too much money.

Coming to trucks for gravelling on main highways, I will not touch on the question of different makes of trucks except in one phase and that is capacity. While the lighter trucks will make better time, they will not deliver the yardage on the road that the heavy trucks do, nor will the cost of operation make any appreciable difference.

The truck operated in District No. 3 this past season was a 3½ ton Diamond T equipped with 4-yard gravel box. This truck was worked in conjunction with hired trucks. As the truck arrived late in the season and the driver was only getting used to it at the end of the work and the road travelled over was not in the best shape, the costs will probably be bettered next season.

The trucks were loaded from bunkers and eight hours constituted a day's work. The initial haul was 2.3 miles on which ten trips a day were kept up until 2.9 miles were reached, making an average return trip of 5.2 miles a day. From 3.4 to 3.7 miles, eight trips were obtained, the average return trip being 7.1 miles or 56.8 miles a day. From 3.7 to 4.6 miles, seven trips were obtained with an average return trip of 8.3 miles or 58.1 miles a day.

Cost of Operation

The costs given below will be based on the work of the Diamond T truck for 15½ days on an average haul of 4.15 miles or 8.3 miles return trip.

Driver's wages 15½ days at $6.00	93.00
Gasoline, oil & grease	93.30
Minor Repairs	20.00
	$206.30

Material hauled 432 cubic yards. Cost per yard hauling 48c.

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*District Engineer.

These figures do not go into interest charges, depreciation of truck, or renewal of tires; but are simply data gathered for the purpose of basing the contracting of gravel work next season.

This season we paid $26.00 a day for rented trucks, everything found. The rented trucks had only a capacity of 2½ yards and on the average haul of 4.15 miles, the material delivered cost us $1.48 per cubic yard, as against 48 cents with our own truck. The difference of $1.00 is too much as a charge for depreciation and profit and is due to two reasons, one of which can be rectified. First, the capacity of the trucks, second, the fact that the other truck owners felt that when they made the same number of trips as our slower and heavier loaded truck they were fulfilling their contract. This could have been overcome in the rental agreement by calling for the speed for which the particular truck is catalogued.

Care should be taken to balance the number of trucks used so as to insure economical loading. For example, at one time we found that we could not keep our bunkers supplied with one slip team, but that by employing two teams they both stood idle about a third of the day. By putting on two extra trucks both teams could be kept busy and the extra trucks worked, without extra loading cost.

Dumping of Trucks

The difference in time between mechanical dumps and hand dumps averaged about three minutes. On short hauls this would become a factor that would have to be considered.

In conclusion, while no comparisons with team work have been made in this paper, it is now a well established fact that we can never cope with the present traffic with teams and that the motor truck will have to be our future means of transporting materials.

Reconstruction in the Building Industry

Two Fundamental Questions Involved are Contract System and Functions of the Architect and Contractor

By Sullivan W. Jones*

BEFORE the war the whole building industry was on a false basis. The competitive stipulated sum contract system had a corrupting influence on every one who became involved in it. The architect, with few exceptions, had failed to develop the professional service part of his function. He had stood still, while changes took place with kaleidoscopic rapidity. There were many indications that he was on the high road to enslavement by the contractor. The general contractor and sub-contractor found it well-nigh impossible to secure a reasonable profit honestly. The manufacturers of materials for construction had been forced by price competition, resulting from the inability of the architect, the engineer and the owner to recognize or measure quality and fitness of such materials, to make exaggerated and often wholly false claims for the merits of their products; and this condition had been stimulated by the cupidity of the contractor. Demand for worthless by-products and cheap substitutes had been created at tremendous and constantly increasing cost to the consumer through the employment and prostitution of the power of advertising and salesmanship by manufacturers with an insatiate appetite for profit. Competition by unscrupulous rivals, who, in sacrificing quality to cheapness, have under-cut prices, had forced the conscientious manufacturer to devote his entire energy to defending his product, and robbed him of all incentive to improve it. The same kind of competition among contractors had driven the standards of work steadily downward. This condition had its effect even on work that was not competitive, for here too, the general contractor resorted to the same shameful tactics in selecting his sub-contractors that he was obliged to employ when he himself was selected competitively on price. Indeed the most casual inquiry discloses that every phase of the industry displayed symptoms of the destructive influence of price competition. Utter moral, if not financial, bankruptcy was the goal toward which the industry was working. This is not a cheering picture, but it is a true one.

The Two Fundamental Questions

Now the correction of all these conditions is not as difficult as it may seem. There are in reality only two fundamental questions involved; and even these two are closely related. The others are the natural developments of them. One is the contract system; the system of selecting contractors, either general contractors or sub-contractors, through competitive bidding on the price for a complete piece of work, under which the owner buys his building from the contractor or a group of contractors for a sum stipulated in advance of construction. The other question relates to the architect and his function.

The Fallacy of the Lump-Sum Contract System

The contract system which was in almost universal use before the war had evolved about two wholly false assumptions: one, that a modern building can be described by drawings and specifications with sufficient completeness to provide for an accurate computation of costs, and, hence for bids on its construction that are fairly competitive; and the other that the contractors' business is that of selling finished work, and that he is essentially a merchant, who should, but by no means always does, possess a specialized knowledge of the suitable and economical use of the things he buys and sells.

The first of these false assumptions leads us directly to a consideration of the sufficiency of the architect's service; while the latter involves a study of the contractor's status under this form of contract. We have thus established at least one direct relationship between the two fundamental questions. While they have been stated separately, so interwoven are they that discussion of them singly is impossible.

Competition in the Assumption of Risk

Let us assume for the moment that we wish to hold to the lump-sum form of contract and competitive bidding. Obviously, then, we must find some way of giving to the contractor in advance the information essential as a basis for fair competition on price. Can it be done? Drawings and specifications may be improved through further standardization; questions of quantities may be largely removed by the adoption of the quantity system, and the pricing of work may be placed upon a more accurate basis by the "open-price," which will also raise the price standard and assure a better margin of profit to the contractor. But are these partial remedies all that are necessary? There are always several ways of doing a thing, one less costly than another, and there will always be differences of opinion between the contractor and architect as to which is the best, or whether the substitute proposed is permissible under the contract. There will always be disputes over questions of quality because quality, both in workmanship and materials, is well nigh impossible to describe. There is another important speculative element in every lump-sum contract, and it will exist even if drawings and specifications could be perfected. When a contractor signs such a contract, he sells short for delivery over a stipulated period of time, the quantities of labor and material required. It is this element of risk which has now acquired such proportions that no sensible man is willing to assume it. In some localities, in times more normal than these, or than those to which we look forward, the risk to the contractor from a rising labor market has been minimized by wage agreements with organized labor. In other places that stability has not been secured. And the material market never has been and never can be brought under control. Estimating, even under the most favorable conditions will always involve risk to the contractor, and as long as there are risks, competition will be based on risks instead of work to be done. The low bid, whether it be too low or not, will always be the product of the greatest error or the assumption of the greatest risk.

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*Before Institute of Electrical Contractors of New York.

Competition Should Be Preserved

We are forced to the conclusion, it seems to me, that competition on price is economically unsound; which conclusion leads us to ask the question: Which is wrong; competition or the stipulated price? Competition is the foundation of healthy life. It is the necessary stimulant to development, to sustained human effort and efficiency. We should strive by every possible means to preserve competition in the building industry; competition between architects, between contractors, and between manufacturers. But let us also strive to make that competition of the invigorating and not the destructive kind.

Let us, therefore, examine the case for the lump-sum contract. I have said it had a corrupting influence on every one involved in it. Almost every ill and every evil in the building industry, I am satisfied, may be traced to the lump-sum contract. Under it the interests of the owner and contractor are diametrically opposed. The contractor's profit lies between the actual cost of the work and the amount of the contract. The greater the cost, the less the profit; and vice versa. The contractor's aim is, therefore, to deliver as little as possible, while the interest of the owner is in exacting the utmost of the contractor. The contract stands between them setting up antagonisms where there should be co-operation, creating conflict of purpose where unity of interest is essential to success. Under the lump-sum contract the contractor has been a merchant, buying and selling finished buildings. All of us have been misled by thinking of the product rather than the method of production, by fighting over the division of profit rather than considering means of assuring reasonable profits to all who participate in the enterprise, including the owners. That is why the contractor has become a broker trading in contracts which represent finished buildings and their component parts, instead of a constructor or engineer.

Contractor Must Sell Service, Not Merchandise

What is it the contractor has to sell? Service, his expert knowledge of the fabrication of buildings. In the last analysis service is the thing he has always sold, but instead of selling it to his employer, he has sold it to himself. The system has placed a premium on disloyalty and astuteness in the contractor, rather than engineering skill and efficiency.

The same contradictions have confused and misled the sub-contractor. He has wasted his best energy fighting for trade discounts on the materials he purchases in order to resell them competitively at a possible profit. He, too, has struggled to make a livelihood through the purchase and sale of labor and materials when he should have centered his effort on perfecting his service, and finding a market for it. If service is the commodity in which the contractor deals, and we wish to preserve competition, obviously then, competition must be in service and not in the price for finished work. The value of service is measured in terms of results. If economy is one of the results looked for, and secured, let it be an asset to the contractor, instead of stolen fruit to be concealed.

The Architect and the Lump-Sum Contract

But we have not yet put in all the evidence against the lump-sum contract. The architect has not escaped its insidiously evil influence. The average owner, the owner who is inexperienced in matters of construction, undertakes his venture on the assumption that the architect is omniscient, and that when a bid is received on the drawings and specifications, it is all inclusive. This is the fallacy of the complete and sufficient drawings and specifications. A mistake is made when an architect accepts employment without disclosing to his client the unavoidable limitations which are placed upon his service. As the work proceeds, omissions are discovered, differences arise as to what is meant by vague expressions and indications, and the architect is at once placed on the defensive with respect to the sufficiency of his drawings and specifications. He has the choice of confessing his plight to the client or covering it up by compromise with the contractor. Some pursue the former and honorable course, others, the latter. The position of the architect under such a contract is unwholesome. It is unfair to him. It is unfair to the owner who has sought the achitect's advice on the basis of confidence. It is unfair to the contractor. It is a high tribute to the profession and the professional tradition, that so few architects have succumbed to the temptations which constantly urge them to abandon the difficult role of conscientious servant.

The Cost-Plus-Fee Contract

The cost-plus-fee contract, as we have known it, has been a compromise document. The status of the contractor, by reason of his contract liabilities, and by reason of the unchanged attitude of the architect and owner, was not radically different under this form of contract from what it had been under the lump-sum contract. While his interests theoretically coincided with those of the owner, the contractor failed to realize the nature of the relationship, and consequently his attitude of mind remained unaltered. The Committee feels that the change must be complete, and to accomplish that end, it is necessary to make such changes in the document as will give the contractor a new picture of his status and responsibilities. The Committee asserts that, "in the light of recent experiences of the government in the use of the cost-plus-fee system, the following general principles are felt to be fundamental."

(1) The contractor becomes in effect a professional adviser of the owner, as his "Construction Manager" and should be relieved of all contract liabilities inconsistent with such a relationship; (2) For this purpose the owner should pay directly for all materials and should enter directly into contract with sub-contractors rather than having sub-contractors make their contracts with the contractor. Payrolls must perforce be paid by the contractor and reimbursement made by the owner; (3) In view of this professional relationship, no "bond" guaranteeing performance is needed or proper, any more than for the architect.

It is difficult to comprehend at once the full significance of this statement. The principles enunciated find expression throughout the document. There was a discussion at the last meeting on the expediency of changing the term "contractor" to "constructor," or "manager of construction," or "constructing engineer," but it was decided a wiser course to pursue, to use the old and familiar term, and let the contractors' wishes gradually crystallize into the choice of some substitute term which would be more appropriate and more descriptive of the new function.

Separate Contracts

This is the wording of the clause, which, in the older form of contract, was captioned "Sub-contracts." it now bears the title "Separate Contracts":

All portions of the work that the contractors' organization has not been accustomed to perform, or that the owner may direct, shall be executed under separate contracts. In such cases, either the contractor shall ask for bids from the contractors approved by the architect and shall deliver such bids to him, or the architect shall procure such bids himself, and in either case the architect shall determine with the advice of the contractor and subject to the approval of the owner, the award and amount of the accepted bid. The owner shall contract direct with such approved bidders, etc., etc.

This clause, it will be observed, establishes the relationship between the so-called sub-contractor and the owner or architect, which the sub-contractor has sought to realize through the elimination of the general contractor.

Under the new system the contractor sells his services on a professional basis at a certain percentage on the cost or for an agreed fixed fee, and his remuneration is understood to be for the use of his organization and its knowledge of the building business applied to the particular enterprise; in fact, the methods we employ and include in the term professional practice are being approached steadily by those we have been pleased to call contractors and who have had to do with the actual business of building only. The selection of a contractor now becomes a question of the individual's or concern's reputation for honesty, ability, and business judgment rather than a question of a competitive price at which they will undertake the work; his relation with the owner becomes a more personal one—based upon confidence rather than on an entirely impersonal contractual relation.

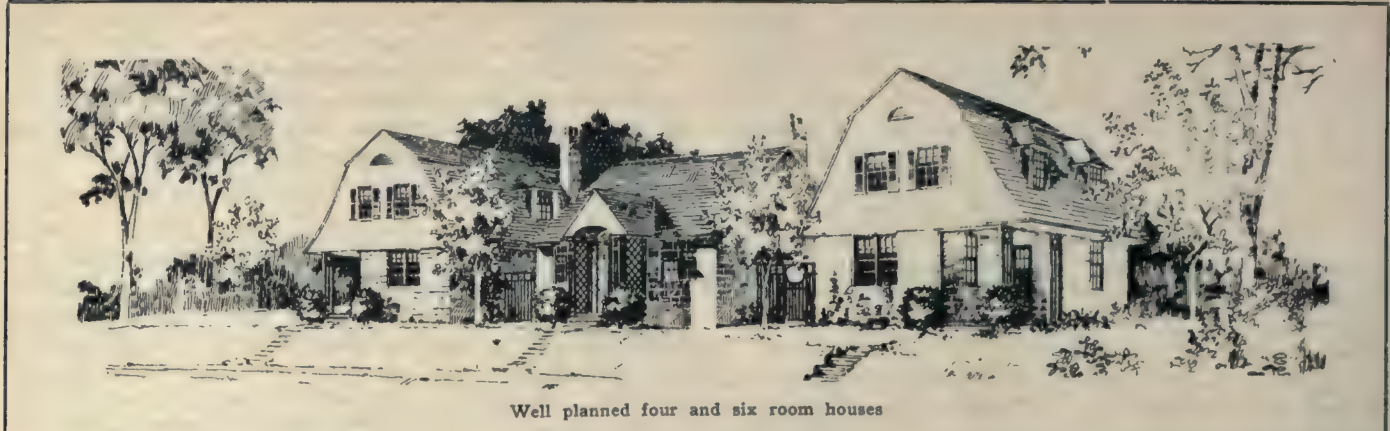
The Advantages of the Cost-Plus-Fee Contract

It must be now plain that the architect's status and function cannot be considered, without considering also the status and function of the contractor. It seems almost superfluous to point out the advantages to the whole building industry from making the cost-plus-fee contract the rule instead of the exception. It is important, however, for us to think of this proposed change in terms of results, so that we may all have a clear conception of what it is we are striving for. But when we think in terms of results, we again find it impossible to think of the architect and the contractor separately. First, the contractor, or let us call him the constructor, will be selected on the basis of confidence and his service record. Since the contractor's profit will no longer depend upon his ability to cheapen the work, which has been the motive underlying the general practice of offering substitutions, we may expect fewer discussions of this kind in the future. Considerations of price alone will less and less influence the selection of materials. The architect and the contractor will work together instead of in opposition. The knowledge and experience in construction which the architect lacks will be furnished by the "constructor." This, to my mind, is one of the most important results that will be secured, for it must be realized, and is realized by the thinking element in the architectural profession, that ability in design, which reaches its highest development only in men who are sensitive, imaginative and impulsive, is wholly incompatible with the scientific quality of mind that works in exact terms of fact and statistics; an essential prerequisite to the proper performance of the "constructor's" function. Under the cost-plus-fee form of contract, the architect, the contractor, and the owner enter into a tri-party agreement to accomplish a single end. It does not require much imagination to see in this change in the contractor's status the reincarnation of the master builder of the Renaissance, through a virtual, if not an actual partnership of the two talents that produced the world's most inspiring and enduring architectural monuments.

The salvation of the architect, the contractor and the industry lie in such a partnership of talents. If it cannot be brought about, I predict that contractors will try to become architects as well, and that architects will attempt to become builders—and, in the broad sense, few will succeed. Buildings will be either poorly constructed or poorly designed, and the loss to the public and in the prestige of the industry will be immeasurable.

Concrete Ships a Failure

The great shipbuilding firm of Swan and Hunter, England, who some time ago began the construction of concrete vessels on Wearside, have abandoned that enterprise. Sir G. D. Hunter, managing director, declares that concrete ships are a complete failure, costing twice as much as those of steel, and taking twice the time to build.



Well planned four and six room houses

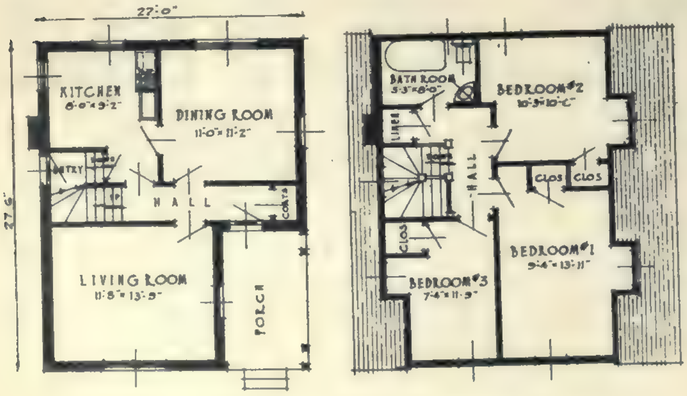
Homes for Trenton, Ont., Housing Commission

Designs of Small Residences Marked by Pleasing Contrast of Exteriors and Convenient Room Layouts

The residences being erected by the different housing commissions contain many features that could well be embodied in the majority of private homes. The arrangement and size of rooms, the elimination of waste space and little used or extra rooms and other similar details are the result of years of investigation and study.

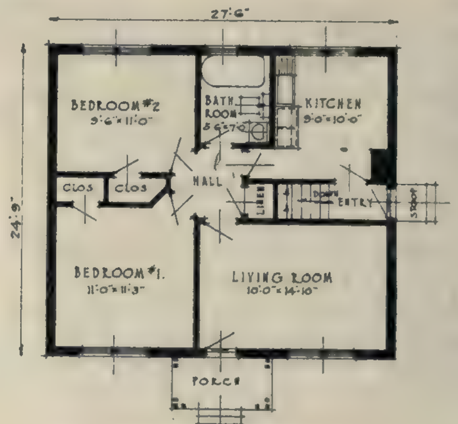
The accompanying sketches illustrate the type of houses designed by William Lyon Somerville, Toronto, for the Trenton Housing Commission. Many housing schemes are spoiled by erecting residences that are very similar in design. True such houses may not be exactly alike but the variation is in detail only and is not marked enough to detract from the monotony of a row of houses of the same general style. The staggering of the buildings helps some and is a very desirable idea to follow but in itself is not sufficient to overcome the sameness of construction.

In this scheme the contrast is more marked and consequently more pleasing. The cosy cottage between the more pretentious dwellings cannot help but lend variety and add to the attractiveness of the whole scheme.



Layout of larger house

A study of the floor plans will reveal the fact that the hall space has been kept as small as permissible. This is in keeping with the idea of doing away with all waste space. There is just sufficient room to provide access to the different parts of the house. Closet space is provided where needed and every attention given to detail so as to, as far as possible, provide a convenient layout and lessen the work necessary to the upkeep of the home.



Plan of Centre residence

The idea of making the rooms of odd sizes is to enable stock lengths of joists and rafters to be used without cutting. This lowers construction costs, for less labor is required to frame the house and a certain amount of waste is done away with. A room 9 ft. 6 in. will require 10 foot joists while if it were made 10 ft. wide 12 foot joists would have to be cut to suit.

One suggestion would be a cheery fire place in the living room. As these houses were designed to be built for a very reasonable figure it was probably found that the amount allowed would not cover such a desirable item.

The city of Montreal has voted $3,500,000, of which $500,000 is for aqueduct improvements, and the balance for various other works, including sidewalks and sewers.

Hints for the Contractor

That May Save Him Time and Money—We Will Pay for All Accepted Items—Send One In

Knock-Down Floor Forms

SLAB and beam floors have been concreted in knock-down forms that are easily handled and facilitate stripping. Ordinary falsework timbers transverse to the beams are first erected and on them the soffit pieces of the beams are laid and the vertical side pieces of the beam forms are put in position, nailed to the soffit pieces, and braced by bottom spacers wedged in position.

The soffit pieces for the floor slab are then set on the side pieces of the beam forms with notched engagement holding them in place and leaving open the corner where the beam and floor intersect. This space is covered by a narrow curved strip of sheet iron tacked to both slab and beam pieces and thus forming an elastic fillet completing the trough system of forms.

When the concrete has set it is easy to knock out the spacers, pull the double-headed nails, collapse the forms and strip them from the concrete in separate pieces more easily handled than massive rigid box forms.

Eighteen Hints for Machine Trenching

THE following useful suggestions for the operation and care of trench excavators were given in a recent issue of "Successful Methods."

1. When spudding down the sides, the bank should be broken off a little at a time as close to the buckets as possible.
2. Keep buckets moving when sides cave and hoist boom clear of cave.
3. Trench braces should be placed as close as possible and parallel to boom.
4. When making a turn with a ladder type boom machine care should be taken not to crowd boom against bank. An oscillating type machine will cut on a 25-ft. radius. A ladder type excavator will turn a right angle in about 150 ft.
5. Manholes can be spudded down—machine elevating all material.
6. The boom should be lifted clear of the trench and rested on a support to relieve strain on cables and to protect boom from cave-in.
7. Always put support under boom to safeguard workmen underneath.
8. Large, loose stones should be taken from trench by workmen. Although machine may elevate them, no chances of delaying operations should be taken.
9. When digging down to a ledge of rock, do not try to dig in with bucket teeth.
10. Obstructions, such as sidewalks, pipes, etc., can be undercut by reversing digging traction.
11. Bracing should be of ample strength to preserve the trench and to safeguard the workmen.
12. Trench should be braced where sewer pipe is broken and in places where water is seeping through sides of trench.
13. Keep bucket teeth sharp. In hard digging keep a spare sharpened set on hand.
14. It is essential to the life and proper operation of a machine that all bolts and parts be always tight. Go over entire machine and tighten all bolts once a day.
15. In loading use heavy plank or timbers properly supported. Make runway of sufficient length to keep boom from dragging. Block wheels at all times.
16. Keep machine level so that sides of trench will always be perpendicular. A few boards under the wheels on the low side will do the trick.
17. Keep a record of your machine's performance. Then you will know just how much it earns for you.
18. Watch out for signs that indicate lack of proper lubrication. A little oil at the right time will often save trouble and money.

Appearance of Concrete Unit

Must Be Improved If They Are to be Successfully Employed in Building Construction

THE future success of the concrete unit for buildings will depend upon the appearance of the unit as much as upon its strength. As a general rule, the possibilities of the looks of the units have been a minor consideration. With the strengths fairly well standardized, the looks must be improved to make concrete units a product that deserves merit. Some notes on the matter of appearance are contained in the following committee report submitted at the National Conference on Concrete House Construction.

For best appearance concrete units should not be made in patterns to simulate other forms of masonry, particularly cut stone, but should always be treated as a separate and distinct building material having a surface finish peculiar to itself, which combines the beauty of natural stone and the ease of cleaning of terra cotta. The use of special aggregates and surface finishes opens fields for concrete block and tile construction previously untouched. With this in mind the following suggestions and recommendations are presented.

Three Types of Units

Concrete building units may be divided into three distinct groups according to use:

1. Interior walls and partitions and foundations below grade.
2. Exterior finished walls.
3. Exterior walls to be covered with portland cement stucco.

Class 1.—Block and tile for interior walls, partitions and foundations below grade require no special surface treatment.

Class 2.—For all units which will form the finished walls of the building and which will not be stuccoed, some special surface treatment to expose the aggregat-

No. 16

Canada's Contractors—Geo. Oakley

Toronto's new union station, now nearing completion, is the last word in railway terminal design, replete with every known aid to the efficient control of train traffic and the comfort of the travelling public. The average traveller, however, will be struck chiefly with the impressiveness of its architecture, which marks it as one of the most outstanding public buildings of the Dominion. On its massive facades and in its lofty concourses are exemplified the finest efforts of the stone cutter's skill, giving a result that is monumental and inspiring. Essentially the station is a building of stone and as such no item in its construction is more important than the stone cutting and erection. For this part of the work, responsibility developed upon the firm of George Oakley & Son, Ltd., one of the premier stone fabricating contractors of Canada, which, besides the Union Station, has to its credit some of the most noteworthy buildings in the Dominion. In Toronto alone, Knox College, Central Technical School, the Toronto Stock Exchange and the Registry building are among the finest of that city's public structures. Among other buildings on which stone was supplied and erected by George Oakley & Son are: Eaton Mail Order Building, Moncton, N.B., the Edith Cavell School, Moncton, N.B., the Navy League Building and four large schools in Halifax, Arcadia College and Nurses' Home, St. John, N.B., Court House, Sault Ste. Marie, and Library at Brantford, Ont.

Mr. George Oakley, the present head of the firm, served his apprenticeship in the stone cutting trade under his father, George Oakley, Sr., who started in business about 32 years ago. He then went abroad and gained valuable experience through four years' connection with stone cutting plants of England and Scotland. Shortly after his return to Canada he joined his father in business under the firm name of George Oakley & Son, the firm in the meantime having been known as Oakley & Holmes, as a result of a partnership formed between Mr. Holmes and Mr. George Oakley, Sr. Mr. Oakley, Sr., has not been actively connected with the business for the past 10 years, his son being the president during that time. The firm handles cut stone of every description and about two years ago started to handle both foreign and Canadian marbles, having acquired the marble department of the Canadian Marble, Metal & Tile Company. Mr. Oakley is also president of the Central Canada Stone Company, at Sarnia, Ont., a subsidiary concern formed to look after the business outside the city of Toronto. With the facilities offered by its Toronto and Sarnia plant, with an aggregate capacity of about 12,000 ft. a month on general work, the firm is able to handle business from one end of Canada to the other. The plants of George Oakley & Son and the Central Canada Stone Company are exceptionally well appointed; every device tending to efficient production has geen installed and machines are widely employed to secure economical operation. One of these, a lathe handling columns up to 32 ft. long and 7½ ft. in diameter, is the largest in the British Empire.

Mr. Geo. Oakley

Mr. Oakley has always taken a prominent part in the affairs of the International Cut Stone Contractors & Quarrymen's Association. He was president, in 1914 and 1915, and is now a member of the Board of Governors and sits on the Executive Committee as the Canadian representative. He is also a past president of the Builders' Exchange and a member of the Canadian Manufacturers' Association and the Toronto Board of Trade.

es and add to the beauty, texture and variety of the surface, is recommended.

The aggregates available for facing concrete units offer a wide choice and variation both in texture and color. Among the aggregates that may be used are screenings from different colored marbles and granites, river and lake gravel, feldspar, micaspar crystals and colored sands. In order to produce a greater color contrast than is obtained with colored aggregates and grey portland cement, white portland cement may be used. A mineral coloring pigment is sometimes mixed with the cement but it is not to be recommended for general use because of the difficulty in obtaining surfaces comparable in appearance, durability and economy with the other types of finish.

Facing Concrete Block.—Methods for applying the facing vary with the type of unit and method of manufacture. It may be applied face down, face up or side face by methods which are a matter of common knowledge in well equipped plants manufacturing concrete products.

Exposing Aggregate.—The exposing of the aggregate can be accomplished in various ways. Among the methods used are brushing or scrubbing, acid washing, water spraying, tooling and rubbing.

Brushing or Scrubbing.—Brushing and scrubbing should be done while the concrete is still green but sufficiently hardened so that particles of the aggregate will not be removed. For this purpose water and a brush with stiff fibre bristles are used. When the concrete has become too hard, a little muriatic acid should be added to the water. Any surface treated with acid must afterwards be thoroughly washed with clean water to remove all traces of the acid.

Acid Wash.—The surface may be washed with dilute muriatic acid, applied with an ordinary scrubbing brush and then thoroughly washed with clean water to remove all traces of the acid. In some instances it has been found more economical to dip the unit in an acid bath instead of applying the acid by hand.

The strength of the solution will depend upon the age and hardness of the concrete but generally varies from 3 to 6 parts of water to 1 part of acid for scrubbing purposes and as strong as 1 to 1 for dipping.

Water Spraying.—This is done with a fine vapor spray as soon as the product is made. The outlet holes should be about the size of a pin and a water pressure of at least 40 pounds is required to give good results. The washing must be carefully done so as not to wash away the facing material. Spraying is necessarily confined to products removed from the molds as soon as made.

Tooling.—Block may be tooled in a manner similar to that used in treating natural stone, the process consisting of chipping or roughening the surface with a bush-hammer, chisel, or other hand or power tool. When colored aggregates are used in the concrete, a pleasing and beautiful texture may be secured. This method, however, is not as economical as the various methods of surface finish previously mentioned.

For tooling, the concrete should be well hardened and at least three weeks old, but better results would be obtained by waiting until it is six or eight weeks old. After about three months the concrete becomes so hard as to make tooling difficult. It is to be understood that the ages mentioned above are only approximate as the methods of manufacturing and curing the unit will have a great effect.

Rubbing.—With certain aggregates, such as marble or granite, rubbing will impart to concrete units a polish much the same as the original stone. After the concrete has hardened, it is rubbed with a concrete brick, carborundum stone, or other commercial abrasive materials or finished on a rubbing bed or "stone table" such as used at marble plants, etc.

Coarse Texture For Stucco

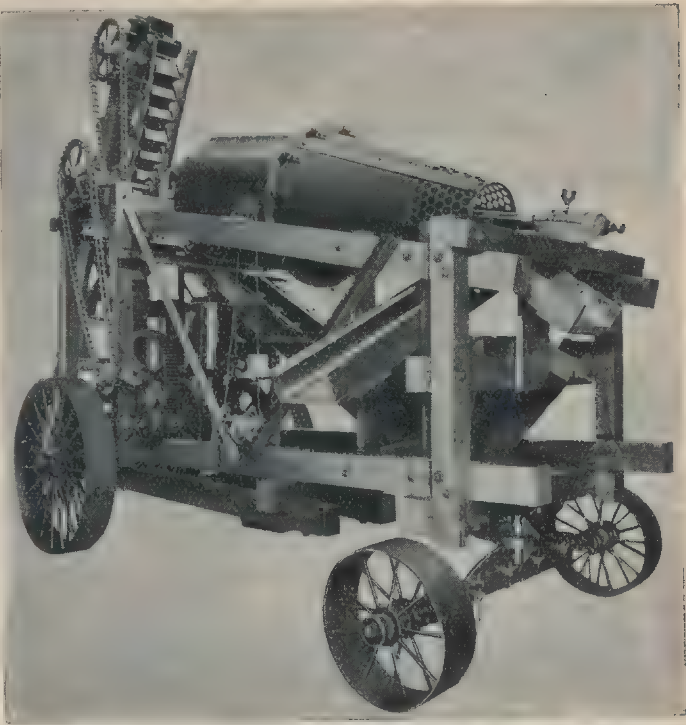
Class 3.—Concrete block and tile laid in portland cement mortar are particularly well adapted to serve as a backing for portland cement stucco because they are composed of the same class of material as the stucco itself and afford an excellent bonding surface. For portland cement stucco finish, the block or tile should be rough and of coarse texture but not weak or friable.

In applying stucco to block or tile the joints should be raked out or cut back at least even with the face of the wall; no projections should be left. The wall should be brushed free from all loose particles and wet down and should be moist at the time the stucco is applied; if dry, the moisture is absorbed from the stucco and a weak finish is the result; if too wet, a film of water prevents a proper bond.

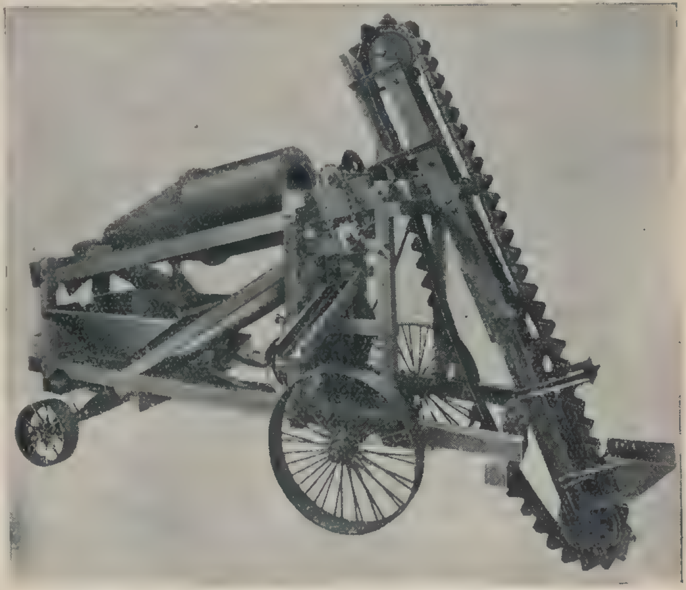
Small Portable Gravel Washing Plant

A SMALL portable gravel washing machine has been developed, not to replace the large permanent plants, but to fill a demand for a small machine which could be moved from bank to bank on road work and contracts where permanent plants are not available and the gravel must be taken from small deposits.

The machine consists of an elevator, preliminary scrubber, screen and sand dewatering device—all mounted on heavy wheels with broad tires. The elevator is made with heavy steel buckets mounted on single strand chain. The elevator frame is so constructed that it can be folded up when the machine is to be moved. A small hand winch is provided to handle the elevator when it is to be folded or unfolded. The scrubber and screen are of the well known Dull patented type consisting of a cylinder mounted on the same shaft as the screen and divided into compartments and having lifting vanes or paddles on the inner circumference of the shell. These are so arranged that the material is thoroughly agitated and washed before it enters the screen. The screen is arranged to divide the material into one grade of sand, one grade of gravel and remove the oversize. The sand and water after passing through the screen drops into a settling tank. The dirty water overflows at the end of the tank and the sand is dewatered by means of a heavy screw conveyor.


A portable gravel washing plant designed for use where permanent plants are not available

The plant is driven by a gasoline engine mounted on the same frame and connected by the necessary gears and drive chain. The machine washes and screens material thoroughly and has a normal capacity of about ten cubic yards per hour of pit run material. It is manufactured by the Canadian Link-Belt Co.


A view of the gravel washing machine from the elevator end

Mainly Constructional

East and West—From Coast to Coast

Fire recently destroyed the main building of the London Collegiate Institute at London, Ont., causing loss amounting to between $300,000 and $500,000.

It is announced that extensions will be carried out at the Ford assembling plant, London, which will practically double the present output.

The architects of Regina, at a recent meeting, decided to form a chapter of the Saskatchewan Association of Architects and will meet bi-monthly.

A by-law providing $250,000 for the construction of a trunk sewer at Niagara Falls, Ont., was carried recently by a vote of five to one.

The personnel of the newly appointed Town Planning Commission at Brantford, Ont., is as follows: Messrs. Frank Cockshutt, J. M. Shuttleworth, Col. M. A. Colquhoun, D. Graves, R. T. McGraw and A. Ballantyne.

The officers of the Builders' Exchange of Galt, Ont., for 1920, elected at a recent meeting are: President, Alex. Robb; vice-president, James Wright; secretary-treasurer, Frank McAuslan.

Engineer E. A. James, of Toronto, has been appointed by the town council of Port Credit, Ont., to investigate and report on the cost of installing an up-to-date waterworks system in the town.

A housing company, to be known as the Greater Winnipeg Building Corporation, has been organized at Fort Garry, one of Winnipeg's suburbs. Mr. C. W. U. Chivers is manager.

A delegation from Toronto, headed by Mayor Church, waited upon the Dominion Government recently, asking that a bridge be erected between the mainland and Toronto Island. The Government promised consideration.

The directorate of the Board of Trade, St. Thomas, Ont., has elected Ex-Mayor E. A. Horton, president; Ex-Mayor George Geddes, vice-president, and Mr. J. L. Lodge, secretary and publicity commissioner.

The United Brotherhood of Carpenters and Joiners at Guelph, Ont., has accepted the Master Builders' offer of 75 cents an hour until July 31st and 85 cents an hour after that date. This new scale has been based on a 44-hour week.

The brick manufacturing plant of R. H. Hamley, Bowmanville, Ont., has been sold to the firm of Hircock Bros. & Company. The new owners are making extensive improvements and alterations to the plant, which will turn out about 15,000 brick a day.

The B. Blair Company, of Woodstock, Ont., has been taken over by the Independent Concrete Pipe Co., Ltd. The new company will manufacture a full line of concrete pipe, from 6 to 108 in. in diameter. The present plant will be considerably extended. Mr. Blair is president and general manager of the new firm, which is capitalized at $200,000.

Several of Hamilton's leading citizens, city officials and members of the city council were present when the city's new pumping equipment was set in motion recently by Mr. Adam Brown, who, as chairman of the water committee of the city council 60 years ago, presided at the opening of the city's first waterworks system.

The directors of the Dominion Bridge Company, of Montreal, announced recently the formation of a new subsidiary company, to be known as the Dominion Engineering Works, Ltd. The recently formed Dominion Engineering and Machinery Company will dissolve into the new firm, which will be capitalized at $10,000,000.

It is estimated that 5,000 men will be employed on the construction of the Provincial Highway in Ontario by June 1. There are, at the present time, about 1,000 men engaged in this work, and, according to Mr. W. A. McLean, Deputy Minister of Public Works, when this system is completed it will surpass even the Lincoln Highway in the United States.

The annual report of the Workmen's Compensation Board of Ontario, for the year 1919, shows that $4,192,859 was paid out to injured workmen as a result of 44,260 accidents. The totals for the year 1918 were, $3,883,994 for 47,848 accidents. The larger total of money paid out during 1919 compared with 1918, for the fewer number of accidents, is accounted for by the increased wages of the past year over those of 1918. A comparison of the average earnings of workmen who came within the scope of the Compensation Board's work for the years 1915-1919 inclusive is interesting. In 1915 the average weekly wage was $13.27; 1916, $15.63; 1917, $19.06; 1918, $21.93, while in 1919 it reached $24.80.

Personal

Lieut.-Col. Milton Francis, D.S.O., has been appointed Industrial Commissioner for the city of Port Arthur, Ont.

Alfred Samson, superintendent of the Levis Drydock for the Federal Public Works Department, died recently at Quebec City.

Hon. Senator P. B. Casgrain was re-elected president of the Provincial Land Surveyors' Association for the year 1920 at the annual meeting held recently at Quebec city. It was decided to hold the next annual meeting at Montreal.

Mr. John Gaskin, auditor with the Foundation Company, Victoria, B. C., has been appointed assistant secretary-treasurer of the company, succeeding Mr. J. E. McCormick who has been transferred to other duties.

Mr. Christopher J. Yorath, city commissioner of Saskatoon, is visiting the larger Canadian cities, including Montreal, Toronto and Ottawa, for the purpose of inspecting the incineration plants at these points and securing information for a plant which the city of Saskatoon intends constructing.

Major-General Sir David Watson has been appointed chairman of the Quebec Harbor Commission, succeeding Hon. D. O. Lesperance, who resigned about a month ago. With Major-General Watson on the new commission will be Mr. Alfred S. Gravelle, of Levis, Que., and Brig.-Gen. T. L. Tremblay.

Business Administrator W. W. Pearse, of the Board of Education, Toronto, returned to that city recently after a tour of the cities of Buffalo, Detroit and Cleveland, for the purpose of inspecting the schools in these cities. Mr. Pearse reports that many good ideas were gathered with regards to seating, ventilation, lighting and construction. Mr. Pearse was accompanied on his tour by Trustee Joseph Bell.

Obituary

Major T. Harry Jones, for 37 years city engineer of Brantford, Ont., died in that city recently after a short illness. Major Jones had been responsible for almost every piece of work of an engineering nature carried out in Brantford.

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University of Toronto Buildings Show Lack of Proper Planning

It is with a large measure of pride that we can point to most of our public buildings and institutions. We are justly boastful of their architectural beauty which stands as a tribute to the ability and resourcefulness of, in most cases, Canadian architects. But anomalies there are—architectural atrocities which offend the eye and that sense of the fitting and becoming. It is amazing with what apparent disregard of true architectural principles some designers have labored and with what lack of good taste their ideas have been formulated. We can see too many instances of such in any of our large cities—buildings entirely unsuited for their purpose, out of all accord with surroundings or grotesque in their own architecture. Far too frequently architects have failed to correlate the buildings they design with those in their neighborhood, with the result that we have thrust upon us hideous eyesores that even the effect of time can hardly blot out.

Such an instance is flagrantly in evidence in some of the new buildings being erected for the University of Toronto. All Canadians know, by reputation at least, the beauty attributed to that institution's main building and those few others that are fitting companions on Varsity's campus. But there are some that unfortunately fail to maintain the same standard of excellence. Mediocre design has made them unbeautiful if not eyesores. The latest is the addition to the Faculty of Applied Science, on which is again displayed an utter lack of concord with the general nature of the surroundings. The University of Toronto is a public institution supported by the people and there is no excuse for stinting the appropriations to such a degree that it is not housed in a manner that befits its importance. It is a potent factor in the development of our country and as such it deserves the best that our government can give it. As it grows it should be allowed to develop in keeping with the excellent foundations that were laid years ago and one way in which it can so grow is by the correlation of the general design of its buildings.

Proposed Tax on Unlicensed Insurance Would Eliminate Needed Competition

The proposed legislation at Ottawa to tax unlicensed insurance companies is causing various organizations and large business firms to enter vigorous protest with Sir Henry Drayton, Minister of Finance. It has been pointed out that the imposition of a discriminatory tax of 15 per cent. on premiums of insurance written by unlicensed companies, would cause an almost complete elimination of such insurance and would, at the same time, yield the federal authorities no appreciable amount of revenue. If competition is the life of trade—and it undoubtedly is—many interests feel that the mutual companies should have no such handicap placed in their pathway as is mooted.

It is stated that about 80 per cent. of the total insurance on property in Canada is already controlled by licensed companies, thus practically constituting a monopoly, and that a tax on unlicensed companies would virtually put them out of business in allowing the licensed organizations to have full swing. This would, it is contended, result to the disadvantage of the country as a whole.

The Canadian Manufacturers' Association recently laid certain facts before the Minister of Finance. That body submitted that the value of the competition from unlicensed companies could scarcely be exaggerated. It had not only been responsible for a maintenance of reasonable rates but had been an important factor in the reduction of Canada's appalling fire waste. The attitude of the C.M.A. was summed up in the declaration that insurance is not a proper subject for taxation and that it is not in any sense a commodity. It was pointed out that an insurance policy is a contract under which the insurer agrees to pay a financial indemnity in the event of certain conditions arising, and, therefore, the taxes paid by licensed insurance companies cannot be considered as a levy on insurance. Such assessments are very properly imposed for the privilege of carrying on a profitable business and hamper the insurance companies to no greater extent than the taxes paid by other firms.

The Association also sets forth another feature, which should not be lost sight of, viz., that, while the transaction of insurance with unlicensed companies involves sending considerable sums of money out of Canada, it also involves the sending of no small amounts into Canada through the payment of losses. The manufacturers believe that the harm done to the community as a whole through the imposition of a tax on persons taking advantage of the existing competition, would much more than offset the comparatively trifling revenue to the Dominion which such a tax would produce.

U. S. Engineering Societies Plan Powerful National Organization

THE Joint Conference Committee of the American Society of Civil Engineers, American Institute of Mining and Metallurgical Engineers, American Society of Mechanical Engineers and American Institute of Electrical Engineers, has issued a call to the engineering organizations of the United States for an organizing conference to be held at Washington, D. C., on June 3rd and 4th, 1920. This action is taken pursuant to the following resolution unanimously passed January 23rd, 1920, at a joint meeting of the governing boards of the above named societies and of the American Society for Testing Materials, which constitute the member-societies of Engineering Council, also of the trustees of United Engineering Society and members of Engineering Council:

"Whereas, this conference of national engineering societies has considered the recommendations of the Joint Conference Committee of the Four Founder Societies, therefore, be it

"Resolved, that the conference adopts in principle that report and requests the Joint Conference Committee to call, without delay, a conference of representatives of national, local state and regional engineering organizations to bring into existence the comprehensive organization proposed."

The purpose of the conference is to secure the cooperation of engineering and allied technical organizations to further the public welfare wherever technical knowledge and engineering training are involved and to consider matters of common concern to these professions. All engineering organizations whose chief object is the advancement of the knowledge and practice of engineering and the allied technical arts and which were not organized for commercial purposes are expected to send delegates.

Principles Underlying Proposed Organization

A plan of organization has been forwarded by the Joint Conference Committee upon the following principles:

1. Non-intereference with the inter-relations with respect to technical matters, and the maintenance of the autonomy, functions and operations, of individual organizations.
2. Local affiliation of existing groups of engineers in order to facilitate united action in local questions of public welfare and other matters of common interest.
3. National association of engineering organizations by means of a National Council composed of representatives widely chosen by local affiliations or organizations and by national organizations, meeting annually and acting through an Executive Board.
4. Financial support of such association by contributions from all participating organizations on a basis of membership.
5. A form of organization which will permit expansion and development.

The Joint Conference Committee is endeavoring to incorporate these principles in the form of a Constitution and By-laws, which will be subsequently presented. Many plans have been considered and it is hoped that the results presented will be found adequate for inaugurating the comprehensive organization proposed, and that the plan will be judged, not upon the basis of detail, which may be modified, but upon the general purpose and the principles above outlined.

Representation in Organizing Conference

As a basis of representation in the Organizing Conference, the following will be tentatively used:

Each national organization will be entitled to one delegate for 100 to 2,000 members and an additional delegate for each additional 2,000 members or major fraction thereof. Each local, state or regional organization or affiliation is entitled to one delegate for 100 to 2,000 members and an additional delegate for each additional 2,000 members or major fraction. A local section, branch, chapter or association of a national organization will be represented through its national organization; this, however, shall not prevent its representation also as a part of a local affiliation.

School Collapse Case in Court Goes Against Contractor

ANOTHER chapter in the history of the new school building for the School Commissioners of St. George le Thaumaturge, which collapsed before its completion, is written in a judgment of the Quebec Court of Appeal. The result is a dismissal of the action of the contractors, J. B. Martineau, et al., to recover $26,781.40, a sum they alleged was due to them under the contract. The action was entered against the commissioners of St. Gregoire le Thaumaturge. Their school municipality having been annexed to Montreal, the defence was taken up by the Central School Board.

The amount sued for was made up of the three following items: $14,040 representing the deposit made by the contractors as guarantee of the execution of the contract; $6,625.50, representing fifteen per cent. of the approximate value of the work executed, and retained by the commissioners; and $5,800, being the value of the materials alleged to have been taken possession of by the school commissioners.

Who Broke the Contract?

The school building, as far as it had then been constructed, collapsed on March 9, 1917. After an investigation, the contractors were ordered to demolish what remained of the structure and proceed to reconstruction. They declined to accept the report of the engineer on which this order was based and demanded that experts be named in order to establish what work should be done. The School Commissioners took this as a refusal by the contractors, and, under a clause in the contract applicable to the circumstance, had the work executed by others.

The contractors pretended that the commissioners

No. 23

Canada's Engineers—H. S. Johnston

Mr. Harold S. Johnston, who was recently appointed hydraulic engineer of the Nova Scotia Power Commission, is a graduate of McGill University with extensive experience in hydro-electric work, chiefly in the Province of Alberta. His chief connection with electrical work was as engineer of the Calgary Power Company for a period of four years, covering the construction of two hydro-electric plants of over 30,000 h.p. capacity.

Mr. Johnston is a native of Gananoque, Ont., where he was born in 1885 and where he received his preliminary education. He graduated in civil engineering with the degree of B. Sc. from McGill University, Montreal, and during his vacations in his college course he was connected with railroad survey parties, chiefly with the Canadian Pacific Railway. In October, 1909, he took a position as instrument man and assistant resident engineer with the firm of Smith, Kerry & Chace, consulting engineers, Toronto, on a 1200 h.p. hydro-electric plant at Nipissing, Ont., in the following January taking a similar position on the 19,500 h.p. plant for the Calgary Power Company, which was also designed by the same firm of engineers. In May of 1911 he became resident engineer and superintendent of construction for the Calgary Power Company and in this capacity superintended the completion of the plant and undertook the survey and design of a 55,000 volt, 50-mile transmission line and investigated and reported on two storage propositions in the mountains. He also was in charge of a 44,000 acre-feet storage reservoir including the construction and design of a dam, bridge, wharf and 125 acres of clearing. The Calgary Power Company then undertook the construction of a 12,000 h.p. plant and Mr. Johnston was in charge of surveys, details of design and field engineering of that proposition, also handling an addition to a sub-station, and the addition of a final 6000 h.p. unit to the 19,500 h.p. plant. Two storage propositions were also investigated and tentative designs of structures prepared.

After four years with the Calgary Power Company, Mr. Johnston became engineer and superintendent of construction for the Department of the Interior, on the installation of 2½ miles of 20 in. steel water main and 1200 ft. of 10 in. main and the design and installation of intake works at Banff, Alta. He also carried out various surveys for the Department of the Interior and Calgary Power Company in connection with hydro-electric and storage propositions. A survey and report for a scenic railway up Cascade Mountain, at Banff, 9,896 ft. above sea level was also prepared by Mr. Johnston. After being on active military service in Canada, he became assistant district superintendent of the Engineering Branch of the Department of Soldiers' Civil Re-establishment, associated with G. A. Browne, Western superintendent on the construction and upkeep of departmental institutions between Winnipeg and Victoria, and more particularly the extension to Tranquille Sanitarium, B. C., at a cost of $300,000 and the construction, not yet completed, of Keith Sanitarium, Alta., which will cost $500,000. In March, this year, Mr. Johnston was appointed hydraulic engineer for the Nova Scotia Power Commission, in which position he will generally assist in all the projects of the Commission, but his immediate duties will be the investigation and preparation of design and estimates for the two developments on the East River Sheet Harbor to supply Pictou County and the industrial area around New Glasgow and Trenton, etc. These two plants will have a total installed turbine capacity of about 20,000 h.p. under any heads of 105 and 65 ft. In coming to Nova Scotia, Mr. Johnston finds himself impressed with the very considerable advantage that must accrue to the province of Nova Scotia from the development of its larger water powers which will mean a tremendous advance in its industrial status.

Mr. Harold S. Johnston

thus broke the contract and accordingly were liable for the money herein sued for. On their side, the school board denied putting an end to the contract and pleaded that in executing the work in place of the contractors, when the latter refused to do it, the commissioners acted within their rights under the contract. The Superior Court upheld the commissioners' view and dismissed the action of the contractors, who thereon took the issue to the Court of Appeal.

Chief Justice Lamothe, in pronouncing judgment, said no expert advice was necessary to establish the necessity for the demolition of what remained of the school building. That was evident; the work was urgent and the contractors ought to have proceeded with it at once. In refusing to do so, after receiving due notice of the school board's demands, they violated one of the clauses in their contract, and in accordance with its provisions the commissioners were legally entitled to see to the execution of the work themselves. The clause concerning arbitration had not in view any such situation as the one created.

The court concurred in the conclusion that the contractors' action was premature, and for the following reasons: The contractors' deposit and 15 per cent. of the value of the work had not to be remitted to them until after the execution of the work; and as to the value of the materials in possession of the commissioners, these materials had not been put into use when the contractors entered their action, but they remained in the place where the contractors left them.

"We confirm the judgment and dismiss the appeal," concluded the Chief Justice, "because the appellants were bound by a clause in the contract not to discontinue the work. And that clause, being legal, must be obeyed. Discontinuation of the work for a short period gave the School Commissioners the right to act in the manner they did."

B.C.'s Experience With Concrete Roads

D. W. Johnston, Assistant Engineer, Department of Public Works, Speaking Before Provincial District Engineers Urges More Attention to Water Content to Secure Best Results

WITHIN the past few years the improvement and progress of concrete road construction has been remarkable. Concrete may be considered too hard and non-resilient for horse-drawn traffic, but as this class of road transport is fast decreasing, the traffic conditions which concrete roads are expected to satisfy, seem likely of being fulfilled.

Concrete roads generally are more costly to construct than other classes of paving, but when the advantages of long life and low maintenance and repair expenses are considered, it may be safe to classify the concrete road as one of the cheapest, if not the cheapest, road construction.

On concrete road construction more minute inspection is necessary than required in other classes of paving. The inspector should be a man of absolute integrity, broad perspective and quick judgment, and familiar with the fundamental principles underlying each clause in the specification. On the Island Highway the writer was very fortunate in having an inspector who ably fulfilled the duties assigned to him; and the high quality of the concrete laid is largely due to the high standard of inspection given the work.

Foundations and Drainage

As in the construction of any kind of road too much stress cannot be laid on the importance of providing a good and sufficient foundation and adequate drainage facilities. Upon the solving of these two governing factors chiefly depend the maintenance and repair expenditures and the life of the paving. On sections of road where the sub-soil is weak or of a character which will retain water, special subsoil drainage facilities should be provided in order to rapidly remove all moisture after a rainfall. No hard and fast rules can be laid down in this connection which would be appropriate to all circumstances, the drainage requirements being principally governed by the level of road with relation to the abutting land, the nature of the subsoil and the quantity of subsoil drainage to be intercepted. Where the level of road is above the abutting land, natural road drainage facilities are generally obtainable, and a good foundation is obtainable by removing all weak subsoil material and substituting gravel, stone or other hard materials.

Where weak subsoil is encountered in cuts, a different problem is presented, requiring careful consideration. In this case, a good foundation is possible only when the subsoil underground water is kept at a steady and constant level during and after rainfalls. Many failures in road construction are caused through lack of subsoil drainage facilities.

It is not sufficient to provide for the rapid removal surface drainage only, and it should be borne in mind that the greatest run-off of surface drainage during a heavy rainfall takes place when the subsoil is water-logged.

The subsoil is the real working foundation of the road, and it is obviously necessary that provision should be made to avoid any change or displacement taking place in its formation after the wearing surface has been constructed. Where road subsoils are subjected to varying moisture conditions, the life of the road crust will be of short duration, due to the displacement of subsoil water and the lateral spread of subsoil material under heavy traffic.

The more quickly the subsoil is dried up, the conditions most conducive to uniform temperature are obtained, and as concrete pavings are more susceptible to temperature changes than any other class of road construction, it is essential that the level of subsoil underground water be kept as constant and as low as possible.

The three methods most common in use in disposing of subsoil drainage are as follows:

(1) By laying a tile drain in trench along the centre of road with transverse laterals to each side of road, the trenches being filled with clean stone.

(2) By laying a tile drain under the earth or gravel shoulder abutting the sides of paving, the drain being covered over with at least nine (9) inches of clean stone.

(3) By laying a drain tile at the toe of all slopes in cups at a depth of about 18 inches below subgrade and covering same with clean stone.

The third method was adopted on the Island Highway contract.

Although any of the above methods will, if operating satisfactorily, keep the road foundation dry at all times, none of them will assist in counteracting the lateral "spread" of the subsoil material, which is very often the cause of collapse of a paving.

The writer suggests that wherever a clay, sandy clay or other weak subsoil is encountered, the subsoil be drained and strengthened by buttressing the shoulders. This could be done by constructing trenches 1 ft. 6 ins. wide and deep, alongside of and abutting to edges of paving and filling same to the surface of the road with clean boulders, stones or gravel of 4 to 6 inch gauge well rolled down. These buttresses, in addition to strengthening the road by holding the subsoil in place and preventing any internal lateral spreading movement, would efficiently drain the soil under the road (outlets at intervals and in low places being provided), and also make the construction of deep ditches along the sides of road unnecessary.

If the sides of all paved roads were installed on a Telford stone base, the problem of draining and strengthening the subsoil would be solved.

In submitting this suggestion the writer is influenced by the fact that in recent years the consideration of new road construction has been limited generally to the wearing surface or crust, the varying nature of the subsoil and the need for varying types of foundation and drainage provisions receiving little, if any, consideration.

In the placing of forms after the rough grading has been completed, it will be found to be good practice to instal the form on one side only until the concreting materials are distributed. This facilitates the movement of material delivery trucks and avoids the damage to forms which would otherwise take place. In the distribution of materials alongside of subgrade, it is very essential to have a man specially engaged in carefully spotting and checking the requisite quantities of concreting materials. If this is not done the piles of sand and gravel will be either too close together or too far apart.

On several occasions during concreting operations on the Island Highway the writer has observed loads of gravel and sand being shovelled off the subgrade on account of materials being distributed in excess of requirements and on more numerous occasions the concrete operations have been forced to shut down, through materials being placed too far apart, until extra loads of aggregate were brought in by trucks under adverse hauling conditions.

In the event of dirty gravel or sand having to be washed on the site, it is advisable that all washing be done clear of the subgrade.

In laying out the paving it is advisable to offset the alignment pegs for wooden forms at least three (3) feet clear of the true alignment. On the Island Highway one foot offsets were at first used, but later changed to 3 feet, owing to their interference with the sub-grade operations. These pegs can also be used as fixed marks, showing the respective cuts or fills to the tops of side forms, or it may be considered advisable to set the tops of these pegs to paving grade.

To ensure thorough consolidation of all road embankments and to allow sufficient time for determining the requirements of the varying subsoil which may be encountered in excavations, it is advisable that all excavations, embankments and drainage facilities should be completed prior to paving operations being commenced. If it is possible to close the road to traffic, the rough grading should be completed before the rainy season and the paving commenced in the spring.

With reference to the methods to be employed in the grading works the specifications appear to be very complete, with the exception of the two-foot minimum width of earth shoulders abutting on paving, as shown on standard cross sections. This minimum width, it is suggested, should be increased to five feet, thereby providing a stronger support for sides of paving and also allowing better foothold for horse-drawn traffic.

Subgrading

In the preparation of subgrade in the Island Highway a 2 in. x 6 in. wooden template was used, having ½-in. bolts, 9½-in. long, and threaded for nuts, inserted every two feet. The template was checked 4 inches on ends to allow it to ride on forms. Very effective work was done by this means, the bolts being capable of adjustment to conform to the required subgrade, and when pulled along forms scored the subgrade to the required level to which the subgrading crew had to excavate. If the initial subgrading work is carefully done the final subgrading under the boom of the concrete mixer, in advance of concreting will consist simply of dressing and trimming the subgrade to ensure freedom of movement to the template used for checking subgrade in advance of concrete being placed, and can be handled by one man.

It may be convenient here to point out that to ensure free movement of the template used in checking subgrade, the subgrade must necessarily be excavated slightly deeper than is required to provide the specified depth of concrete. In view of the fact that the additional depth of subgrade must be filled up with extra concrete, the thickness of completed concrete slab will be from ¼ to ⅜ of an inch thicker than specified. The cost of this additional concrete will be about 13c per sup. yard, and it is obvious that the specification should make particular mention of this matter.

In the preparation of subgrade it is essential that the surface should be as smooth as possible so as to offer as little resistance as possible to the contraction and expansion of the concrete. All irregularities in subgrade should therefore be removed. In this connection it has been suggested by some authorities, with apparent good reason, that a thin layer of sand migh advantageously be used under concrete pavements to facilitate the sliding of pavement, due to expansion and contraction. It might be pointed out that if a thin layer of sand was substitued for the additional depth of concrete, the cost of concrete would be reduced about 10c per square yd.

Mixing and Consistency of Mix

The specification defines the consistency of mix as such that when struck off with a template it will hold its shape, etc. From experience on the Island Highway the writer is convinced that the above is not sufficiently explanatory. As there is a slump in all concrete when placed, it is obvious that no concrete, when struck off, can hold its shape; the amount of displacement depending on the quantity of water used in mixing. The more water used in mixing, the easier and more economically concrete can be handled, and for this reason contractors generally are not guilty of providing any more "elbow grease," than they have to, consequently the consistency of mix, like prohibition, is likely to be wetter than intended.

In the United States the quantity of water recommended generally to be used in mixing concrete for road purposes is from 21 to 22½ Imperial gallons per cu. yard of concrete. This may be of some guidance to engineers in their initial concrete road work, and again it may not be. The quantity of water required for concrete mixing depends entirely on the absorption and the size and grading of the aggregate. As uniformity in the size and grading of materials and their absorption is hardly possible, the accurate soluton of the matter by experiment is very doubtful. Before going any further into the question of the quantity of water required for mixing, it may be convenient here to refer to the governing factors on which the life of concrete depends.

Factors Governing Life of Concrete

The indispensable condition governing the life of concrete is its strength, denseness and imperviousness and to secure this, authorities on concrete state that a clean, well-graded aggregate with a liberal quantity of cement must be used. While this cannot be disputed, the writer is of the opinion that the most important factor governing the density and imperviousness of concrete, and regarding which proper attention has been lacking is the water content of the mix.

We are told that only about one-half the quantity of water used in mixing concrete is absorbed in hydrating the cement. Assuming that it takes 21 to 22½ gallons of mixing water per cubic yard of concrete, there would be in the neighborhood of from 10½ to 11½ gallons of free water in the body of the concrete, which if left to evaporate, must result in voids equal to about 8 per cent. of the mass. There is, apparently no reliable data yet available as to the quantity of water absorbed in hydrating the cement, but the writer is convinced that 21 to 22½ gallons of mixing water per cubic yard of concrete exceeds the requirements.

The Water Content

On the Island Highway the writer roughly measured the quantity of water being used per cubic yard of concrete, which approximated 16 gallons. The consistency of concrete, when above measurement was taken, was such that the concrete had to be tamped twice, the second tamping bringing moisture to the surface without forcing it to flow. The consistency obtained on the day on which the water was gauged would, in the opinion of the writer, cover what is intended by the specification. It is not suggested that 16 gallons of water is the proper quantity to use in mixing, but rather to prove that the quantity generally recommended—21 to 22½ gallons—may be very misleading.

In the construction of other classes of roads, particularly bituminous bound roads, the most important factor in designing the mixture is the grading of the respective materials in order to reduce to a minimum the percentage of voids in the completed work.

Concrete work has been designed with the same object in view, with the exception that the quantity of water to be used for mixing the materials has been left to the discretion of the engineer. Specifications should emphasize more fully the importance of the water content in concrete mixtures, and although it is not possible to specify the exact quantity to be used, it might be stated that **"the smallest quantity of mixing water shall be used which will produce a workable concrete of such consistency that tamping will force the water to the surface without causing it to flow."** It is also suggested that the specification provide "that at least four men be engaged at the exclusive work of tamping the concrete, which shall be tamped at least twice."

Water is Most Important Ingredient

Should provisions such as the above be included in the specification, there can be very little room for argument between contractor and engineer as to the proper consistency required. Considerable trouble was experienced on the Island Highway in this connection and on several occasions the inspector threatened to close down the plant if the mixing water was not reduced. The water in concrete mixture is a very important, if not the most important ingredient, and, according to a report on experiments recently carried out in the United States, small variations in water content produce more important variations in the strength and other properties of concrete than similar changes in the other ingredients.

On all concrete mixers the water supply is regulated by a valve and it is advisable to mark same after it has been set to conform to the required consistency. This valve will have to be adjusted from time to time, depending on the size and grading of materials being used and the rate of flow in water supply.

The specified time—one minute—for mixing the concrete materials, with a minimum number of drum revolutions of 12, ensures a proper mix being obtained. To accurately time the mixing, the plant should be equipped with a timing device which can be observed from all points in front of mixer. The writer would suggest a device somewhat similar to the timer used in the home in boiling eggs.

In the mixing of concrete, careful and diligent supervision is essential to obtain satisfactory results and the writer considers it is necessary to employ two inspectors; the chief inspector to devote his attention to the exclusive work of the mixing, placing, tamping and finishing of concrete, the assistant inspector to take charge of the concreting materials and the subgrading immediately in advance of the mixer.

Prior to concrete being placed the subgrade should be firm. Particular attention should be given to the portions of subgrade immediately adjacent to the wooden forms, which should be properly banked and strengthened with good, hard earth or other material and thoroughly tamped before concrete is placed.

Expansion Joints

In the placing of these pre-formed joints it is advisable, in order to prevent the concrete from sluffing under the joint in places where subgrade is uneven, thereby defeating the object of joint, that the jointing material be bedded at least one-half inch below subgrade level.

Finishing and Curing

The specification is very complete on these important branches of the work. It is essential that the finishing and curing be given the same care and supervision as the mixing and placing of the concrete. Special attention should be given to the finishing work, that too much mortar and fine aggregate is not worked to the surface. The wearing surface should be uniformly composed of gravel or stone, with sufficient mortar to completely cover and hold same firmly in place. Careful supervision is also necessary in the curing of concrete, that the pavement is kept wet and protected from the sun and wind for the specified period. In this connection some trouble was experienced on a section of the Island Highway, resulting from neglect on the contractor's part to water, sprinkle or protect the pavement during a week-end immediately following the Saturday on which pavement was laid. On the section of paving in question, slight shrinkage cracks were found, clearly demonstrating that the concrete had dried out too quickly. Great care should be taken in selecting the "finisher," as he, more than any man on the work, with the exception of the inspector, can make or mar good concrete.

The plans of the Grand'Mere waterworks, prepared by Messrs. R. S. & W. S. Lea, of Montreal, provide for a supply of water from Lac des Piles, at an estimated cost of $250,000, exclusive of property rights. The water will flow by gravity through woodstave pipes, 16 in. in diameter, to a pumping station about a mile from the town. From here the water will be pumped through cast iron mains, 14 in. in diameter, to the distribution system. Work will go ahead at once.

Baiting Labor Away From Other Contractors

Stealing Men in Spite of Local Agreements is Condemmed—Co-operation is the Solution

THERE are three ways for a firm to handle labor on construction work outside home territory: (1) By joining the local association or local group of general contractors for the period of the work and working in co-operation with them in support of existing agreements or in the making of new ones, if these are desirable; (2) by ascertaining from local contractors what the facts in the local situation are and then acting independently either in accord with them or otherwise; (3) by entering the field and, regardless of local conditions, customs, or agreements, to bid for men by raising the existing scale just sufficient to steal them away from local contractors.

Selfish Actions Mean Industrial Anarchy

There is no doubt that the present shortage of labor and the increased demand for construction make it imperative to revise many existing agreements, wage scales, etc., in order to accomplish the work demanded. For an "outside firm" to do so regardless of local conditions or agreements is not only the quintessence of selfishness but absolutely destructive of the entire frame-work on which co-operation between men, whether in government or in industry, is built. It is nothing short of anarchy in industry. It may temporarily satisfy the demands of the firm so acting, but at the same time it disrupts the work of scores of other men whose right by priority of claim is stronger than theirs. Ultimately it will react to the detriment of the former also when the whole value of labor agreements becomes weakened and useless —"scraps of paper" in whose framing time is only wasted—and the structure upon which any existing stability now rests is destroyed by bad faith among the employers themselves.

On the other hand there is no doubt that when the demand for labor is greater than the supply, some means must be adopted to attract it to those jobs best able to pay the price. Local associations or contractors cannot hope to "sit tight" in the face of increased demand and ask "outside firms" simply to rest content with existing conditions, where those existing conditions do not meet the requirements. In such a situation either the wage scale must be advanced and labor attracted from less desirable localities or some jobs must be suspended temporarily for the sake of maintaining the present scale and at the same time meeting the new demand created by the "outside firm." There is no justification for standing arbitrarily in opposition to economic laws.

Co-operation Will Solve the Difficulty

The important point is, however, that the operation of these laws can best be brought about through the co-operation of all parties interested. If an "outside firm" enters a new local field, it should at once become acquainted with local conditions, local leaders and local agreements. If a thorough canvass of the situation in conference with local contractors shows that only by a revision of existing agreements or a suspension of less important work can the new demand be met, then action can be taken in co-operation to the best advantage of all, and the value and purpose of associated effort and agreement thus maintained. There may, of course, be instances when local contractors cannot be brought to see the inevitable working of economic laws, and in these exceptional cases independent action is justified—but only after every attempt at co-operative action has been proved unavailing.

With this in mind the A. G. C. has included in its by-laws the following provision, which is printed herewith for the special attention of all members:

By-laws, Article 1, Section 5: Firms or corporations, members of any associated organization of the Associated General Contractors of America, who shall undertake a construction contract outside the jurisdiction of the Associated Organization of which they are members and within the jurisdiction of any other Associated Organization, should affiliate with said other Associated Organization and abide by their rules and regulations for so long as said firm or corporation shall continue to undertake construction work within that jurisdiction.

(From Bulletin of the Associated General Contractors).

March Building Permits Maintain Advance

ACTIVITY in the building trades as indicated by the value of building permits issued in 56 cities, shows an increase during March as compared with the preceding month, the total of building permits rising from $4,684,934 in February to $8,258,410 in March, an increase of $3,573,476 or 76.3 per cent. All the provinces registered increases in this comparison, those in Ontario, Quebec, Alberta and Manitoba being very substantial.

As compared with the corresponding month in 1919, there was an increase of 145.5 per cent., the value for March, 1919, having been $3,329,050. Nova Scotia and New Brunswick, as during February, were the only provinces to record declines in that comparison. In Ontario and Quebec there were increases of respectively $1,954,307 and $1,136,895. The increases in the other provinces were also large.

The returns from 35 cities originally used in this report (which are distinguished by asterisks) are tabulated separately, and show that the total value of building permits issued by these cities amounted to $7,395,739, an increase of $3,069,940 or 71 per cent. during March as compared with February. In comparison with the figures for March last year, the considerable increase of $4,383,684 or 145.5 per cent. was registered.

All the larger cities, Montreal, Toronto, Winnipeg, Edmonton, and Vancouver, showed substantial increases both as compared with the returns for February, 1920, and for March, 1919.

Of the smaller centres, Quebec, Sherbrooke, Brantford, Fort William, Guelph, Hamilton, Kitchener, Kingston, London, Oshawa, Peterborough, Stratford, St. Catharines, St. Thomas, Sarnia, Sault Ste. Marie, St. Boniface, Regina, Calgary, Point Grey and South Vancouver, showed large increases as compared with both February and March, 1919.

Estimated Cost of Building Work as Indicated by Building Permits

City	March 1920	March 1919	March, 1920, compared with March, 1919 Increase (+) Decrease ( )	Amount		Per cent.
	$	$		$		
Prince Edward Island	....	....		....		....
Charlottetown	Nil.	....		....		....
Nova Scotia	**255,750**	**283,595**	–	**27,845**	–	**9.82**
*Halifax	226,435	256,775	–	30,340	–	11.82
New Glasgow	Nil.	1,375	–	1,375		....
*Sydney	29,315	25,445	+	3,870	+	15.21
New Brunswick	**48,250**	**62,200**	–	**13,950**	–	**22.43**
Fredericton	1,500	Nil.	+	1,500		....
*Moncton	42,250	38,950	+	3,300	+	8.47
*St. John	4,500	23,250	–	18,750	–	80.65
Quebec	**1,531,145**	**394,250**	+	**1,136,895**	+	**288.37**
*Montreal-Maisonneuve	945,496	228,208	+	717,288	+	314.31
*Quebec	392,524	96,467	+	296,057	+	306.90
Shawinigan Falls	Nil.	35,000	–	35,000		....
*Sherbrooke	95,650	5,700	+	89,950	+	1,578.07
*Three Rivers	47,675	14,250	+	33,425	+	234.56
*Westmount	49,800	14,625	+	35,175	+	240.51
Ontario	**3,881,069**	**1,926,762**	+	**1,954,307**	+	**101.43**
Belleville	4,700	22,700	–	18,000	–	79.30
*Brantford	73,955	20,955	+	53,000	+	252.92
Chatham	24,450	7,125	+	17,325	+	243.16
*Fort William	33,850	1,275	+	32,575	+	2,554.90
Galt	14,650	Nil.	+	14,650		....
*Guelph	18,145	4,720	+	13,425	+	284.43
*Hamilton	311,325	229,045	+	82,280	+	35.19
*Kingston	28,330	8,535	+	19,795	+	231.93
*Kitchener	319,690	21,880	+	297,810	+	1,361.11
*London	172,570	58,520	+	114,050	+	194.89
Niagara Falls	30,300	23,100	+	7,200	+	31.17
Oshawa	64,950	19,495	+	45,455	+	233.16
*Ottawa	102,775	234,540	–	131,765	–	56.18
Owen Sound	6,500	Nil.	+	6,500		....
*Peterborough	65,060	2,990	+	62,070	+	2,075.92
*Port Arthur	9,346	5,457	+	3,889	+	71.27
*Stratford	49,625	4,690	+	44,935	+	958.10
*St. Catharines	63,250	23,820	+	39,430	+	165.53
*St. Thomas	19,085	9,960	+	9,125	+	91.62
*Sarnia	61,505	25,020	+	36,485	+	145.82
Sault Ste. Marie	36,275	27,100	+	9,175	+	33.86
*Toronto	2,058,747	1,005,560	+	1,053,187	+	104.74
Welland	13,350	24,950	–	11,600	–	46.49
*Windsor	288,395	143,925	+	144,470	+	100.38
Woodstock	10,241	1,400	+	8,841	+	631.50
Manitoba	**592,575**	**68,200**	+	**524,375**	+	**768.86**
*Brandon	2,425	21,200	–	18,775	–	88.56
St. Boniface	30,250	4,300	+	25,950	+	603.49
*Winnipeg	559,900	42,700	+	517,200	+	1,211.24
Saskatchewan	**294,125**	**119,600**	+	**174,525**	+	**145.92**
*Moose Jaw	23,675	27,500	–	3,825	–	13.91
*Regina	263,750	40,700	+	223,050	+	548.03
*Saskatoon	6,700	51,400	–	44,700	–	86.96
Alberta	**950,325**	**234,225**	+	**716,100**	+	**305.73**
*Calgary	333,400	195,400	+	138,000	+	70.62
*Edmonton	600,650	2,200	+	598,450	+	27,202.27
Lethbridge	11,220	28,860	–	17,640	–	61.12
Medicine Hat	5,055	7,765	–	2,710	–	34.90
British Columbia	**705,171**	**240,218**	+	**464,953**	+	**193.55**
Nanaimo	260	3,415	–	3,155	–	92.39
*New Westminster	21,250	9,700	+	11,550	+	119.07
Point Grey	151,699	33,300	+	118,399	+	355.55
Prince Rupert	26,458	35,400	–	8,942	–	25.26
*Vancouver	308,477	119,013	+	189,464	+	159.20
South Vancouver	129,233	16,690	+	112,543	+	674.31
*Victoria	67,794	22,700	+	45,094	+	198.65
Total—56 Cities	**$8,258,410**	**$3,329,050**	+	**$4,929,360**	+	**148.07**
***Total—35 Cities**	**$7,395,739**	**$3,012,055**	+	**$4,383,884**	+	**145.54**

Sherbrooke Sewer Cheaper to Build in Winter Than in Summer

Frozen Ground Dispenses With Pumps, Bracing and Cradles— 3 ft. 4 in by 5 ft. Brick Sewer in 14 ft. Trench

By Thos. Tremblay*

IN Sherbrooke, P. Q., there is under construction a brick trunk sewer, the work on which was commenced early in the spring of 1919 and is still proceeding very satisfactorily. The size of this sewer is 3 ft. 4 in. x 5 ft. 0 in., and it comprises two rings of hard burned brick, laid in cement, with a tile invert at the base, The sewer is to serve to carry the sewerage to the St. Francis River from the southwest part of the city, where some of the largest industries are located, as the Canadian Ingersoll-Rand Co., Ltd., MacKinnon Steel Co., Ltd., Canadian Connecticut Cotton Mills, Limited. The last mentioned Company have just awarded a contract for an extension to their present mill at a cost of one and a quarter million dollars.

In establishing the size of sewer required to serve this section of the city, the quantity of sewerage to be produced by the inhabitants of that section at the completion of the sewer, was estimated, and this estimate was increased six times; any surplus of surface water is to be carried to the Magog River by a special overflow. The Magog River discharges into the St. Francis River with a gradual fall of 120 feet in about one-half mile distance.

During the fall of the year, until the frost set in and hardened the surface of the ground and the sides of the trench, we were obliged to use vertical sheeting all along the trench on account of the formation of the ground, which is composed of clay with veins of quicksand, and also on account of the vibration, caused by being close to the C. P. R. track. To do the work properly, a diaphragm pump, with two men, was used all the time. The bottom of the trench being in clay with water, concrete was used to form a solid bottom for the trunk sewer and a cradle for the bricks. The cost of bracing, pumping, concrete, etc., in a trench 14 ft. deep, was about $4.00 per running foot. After the ground was frozen, the bottom of the trench become dry, requiring no pumping, bracing, concrete or cradle. The shape of the invert sewer was then cut in the clay bottom and the brick laid on this wall; 6 inches of concrete being laid under the invert to assure a solid base. The cost of breaking the frozen ground on the top was very little. When only one and one-half feet thick, it was broken by blasting with dynamite; the holes for dynamite are bored into the frozen ground through a 3/4 in. iron pipe connected on the steam hose, which works very satisfactorily. I consider $3.00 per lineal foot, at least, is saved by doing the work when the ground is frozen, especially where the line of the sewer is located where there is no traffic.

Building permits issued in St. John, N. B., for the first four months of this year amounted to $301,950 as against $36,000 for the same period last year. April's total is a particularly high one, calling for an expenditure of $257,590. Last April there were no permits issued.

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*City Engineer, Sherbrooke, P.Q.

Warning Against Too General Employment of Concrete For Housing Purposes

It Has, However, A Legitimate Use Which Should be Encouraged—Other Materials Needed For Contrast or Special Purposes

By Irving K. Pond*

THE use of concrete in building operations has grown apace and enthusiasts and specialists have arisen to scatter their words and their works broadcast—sometimes, though not always, the words being more attractive than the works—sometimes the words and works alike bordering on the grammatically atrocious—as for instance when the beauties of cast-rock faced-concrete blocks have been urged and the monstrosities themselves have made pitiable what otherwise might have been semi-respectable structures—"semi," mind you, not "wholly" respectable; for the taste which could advocate, and incorporate into its product, such base imitations could not create or fashion a thoroughly respectable structure. Some two years ago while acting as chairman of a board to adjust, and settle perchance, jurisdictional differences between the carpenters, the architectural iron workers and the sheet metal workers of Chicago, I suggested facetiously that the fabricators of imitations should be penalized by giving over to the trades whose products were imitated the erection of all such imitations. Thus stone masons should erect all tin fabrications simulating stone cornices, architraves or entablatures; and do plastering where plaster simulated Caen-stone—one might put it "con"-stone—on walls and in vaulted ceilings. My pleasantry was met with hearty and strenuous disapprobation—each trade wanted to tell its own little lie and to reap the benefits which each felt certain would accrue to it in a world so slightly endowed with the elements of sincerity or of good taste.

Mr. Irving K. Pond, whise illuminating remarks on concrete housing appear herewith

So my first item of advice is to treat the product with respect, to shun and scorn imitations, to recognize limitations, which attach to all materials, as well as to all men, and to work within those limitations. This is not saying that because a thing has been done, perhaps frequently and appropriately done, in one material, it cannot be done in another or a new material which may be employed with equal propriety; however, the new material should not employ forms which are purely distinctive of the old, but should develop forms which inherently characterize the new. What these characteristic forms may be is a subject for very searching study and analysis. Possibly through synthesis rather than analysis will the characteristic forms disclose themselves. So was it in the past with the old materials—so probably will it be with the new.

Now concrete is a material which lends itself to many kinds of manipulation. It can be cast, poured, pressed, assembled in the shop or on the job; it can be applied in liquid or in solid form to the work immediately in hand. So many are the possible methods of its application—such a diversity of means may be employed toward its legitimate ends, that some of its enthusiastic sponsors see in it a panacea for structural ills and possibly for aesthetic building ills, a substitute for all previously employed building materials—excepting, possibly, door hinges—and a perfect end in itself.

Warning Against Too General Employment

It behooves those who can impartially survey the entire field to offer both warning and encouragement—encouragement in its legitimate use, warning against its too free employment especially where other materials may better serve the conditions. The economics of the general situation favor concrete and through this factor alone there may arise a tendency toward its too general employment; toward its substitution for other materials which, though perhaps costing more in mere money satisfy the senses and better fulfil geographic and climatic conditions. The cheapness and ease of casting a flat slab of concrete has led certain enthusiasts to advocate the general adoption of a flat slab type of roof in any and all parts of the country (and ultimately of the world). It is advocated for a northern climate because it can very cheaply be made strong enough to hold a load of snow and ice. But that is not what a roof is for—it is to shed snow and ice. The flat slab roof is advocated for a southern climate because the overhang or shade is so cheaply procured. The shade is desired but not at the expense of ugliness which results from unembellished overhangs—and concrete embellishments are expensive. The factors of ease and economy in manufacturing concrete slabs, whether to be applied vertically or horizontally, contribute to a "simplicity" which tends toward stupidity and to a barrenness which begets ugliness. Where the general form is stupid and ugly, not much in the way of reclamation can be effected by proportioning of windows or application of superficial ornament. If the mass is interesting and appropriately conditioned, geographically and climatically, slight defects in details will not too seriously challenge the taste, but an ugly mass is fatal.

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*Read before National Conference on Concrete House Construction.

In spite of the fact that the learned ones will point out that concrete was a favorite building material with the ancient Romans, and that traces of it are found attaching to Greece, Egypt and the ancient Orient, concrete as employed by us is a new material, the science and art relating to which are not fully developed.

Architectural Distortions

Because concrete has for so long a time been poured into moulds or forms and because of the coarseness of its ingredients, one of which was stone which could go through a two inch ring, the earlier designers being dependent upon precedent and knowing not where else to look, fell upon the crude Spanish detail and broad masses of the early Spanish Missions as representative of what might be embalmed in concrete. And so Spanish missions distorted into bungalows and cottages and palaces spread like a rash over the face of the country. As technical and mechanical difficulties were overcome and processes refined the rash itched to take another form of disease and turned into a classic fever, with now and then a touch of Gothic "pains" were noted particularly in the traceries on solids and in voids. The fever still burns, the pains still grip. Expensive forms are built up and destroyed to produce effects which already, ad infinitium, ad nauseam, have been better achieved in stone. However, this is not always to be.

Individuality Needed

The waste entailed in the destruction of specially constructed and expensive forms has become apparent to many concrete users and exploiters, and their efforts to prevent the consequent loss, especially in case of the smaller residences, has introduced an element which may well call for restraint in its application. For the sake of economy forms are used and reused in close proximity. When such forms are not perfect in themselves and in utmost good taste, monotony in repetition becomes deadly, and woe is it to him whom cruel fate has condemned to inhabit a unit in an environment so constituted. Life and joy and self-respect must be absent from the dweller amid such surroundings. Even where the forms are charming and singly in good taste, repetition robs them of individuality and unfits them for occupancy by anyone possessed of character and personality. Individuality of character and personality are absolutely necessary in the units which go to make up the mass of a civilized and self-respecting society.

Consequently another injunction, which I offer by way of advice, is to avoid wastage of forms—but even more to avoid the monotony which must follow the unrestrained employment of any "motif," ugly or charming. Introduce spice into life in the way of variety. The principle underlying this admonition is just as applicable to a mill town as it is to the most highly developed suburb. In point of fact little or no distinction should be drawn between the mill town and the "swell" suburb. It should exist possibly only in the size of units; it should not exist in the expression of good taste and mental and bodily comfort.

Other Materials Needed

In spite of the manifold and varied means, methods, processes, applications, manipulations, textures, surfaces and colors appertaining to the use and employment of concrete as a medium of architectural expression and embodiment, I am not certain that I should advise its sole and unlimited agency in housing the activities of any one neighborhood or community. Indeed I am quite certain that I should not so advise; and this not altogether on the ground of a needed variety, but that there are other materials which transcend even concrete as a medium of certain desired expressions of the human spirit in the art of architecture. And I should desire to see no community curtailed of, or denied, the right and power to express the best that is in it in the materials best adapted to that expression. Thus marble, granite, iron, bronze, brick, slate, each one possesses inherent qualities or characteristics not translatable into concrete even through the agency of base and artificial imitation. In the matter of brick, for example, there is scale to the unit which relates the mass to human desire and experience in an intimacy possible with no other material, while in natural color and texture the range is boundless. But, even with all that, brick needs other materials in its neighborhood for contrast and variety, purple-green of slate, soft white of stucco, weathered grey of timbers, with carvings and turnings; and craftsmanship which cannot be imparted by a mould, however exquisitely the surface be wrought by the modeler's hand.

Anachronisms of Architects

I assume that as an architect I am expected to say that the only way to make concrete as accredited and acceptable building material, adapted to all human and aesthetic needs, is to have its essence filtered through the alembic of the architectural profession, or its representatives. Now the most stupid of anachronisms are perpetrated by so-called architects; (they really are untutored archaeologists, or rather grave robbers) and the most blatant of modernisms, cut off from all context of history, have emanated from, again, so-called architects, (they really are unlettered sentimentalists). But I will say that the possibilities of concrete as a medium of aesthetic expression in building may best be apprehended by a sincere architect, with knowledge of modern social conditions and tendencies working in co-operation with those who know the material at first hand and who also are sincerely working to exploit nothing, but to develop the latent and inherent possibilities of a worthy material. Such architects exist, such material men exist. They should come together.

I must say one word here as to what should characterize the architect in whom the material man and the public may well place their confidence, being assured that his will be leadership—real leadership and not selfish and autocratic domination. That architect must not exploit any material or system but must be able to recognize, and free to employ the most effective and appropriate under the individual conditions. He must sense the sociological, including social, the ethical and aesthetic tendencies of his time so as to aid his client in the expression of them, curbing wasteful, demoralizing, disintegrating tendencies, and aiding toward social unification; diagnosing present conditions and meeting the situation with skill and clarity of vision rather than in applying formulae learned by routine in the schools. The architect should think in advance of the public and see the goal and the way thereto more clearly. Pity the public which follows, and condemn the architect who pursues, the selfish and blind course.

Now, in so far as this paper is concerned, its elements may be summarized and augmented as follows:

Imitations—Concrete has a character of its own; there is no call to torture it into imitations of stone, wood, bronze or other material. Details cast in moulds should bear the plastic touch of the modeler and not the chisel marks of the sculptor.

Economy—Forms suited to the special purpose should be used—forms extravagant of labor and materials should be avoided and should be employed only where duplication can be accomplished without monotony.

Monotony—Even a good thing ceases to be a good thing when used in excess and two concrete houses from the same forms, placed side by side is an excess—such treatment is permissible only in barracks where men are in uniform and drilled into the same line of thought, act and movement, all individuality being eliminated.

Slabs—Flat slab roofs may at times and in places be appropriate. A general use would be deadly unless counteracted by features the initial expense of which would more than offset the element of economy which alone would serve to call for a wide prevalence of such roofs.

Monolithic forms—This method presents advantages in certain types of structures. The appearance of mass and strength is enhanced by monolithic treatment. Openings and corners can be characteristically and ornamentally treated at slight or no additional expense. Houses pre-cast from monolithic forms and transported as slabs or as units are to be looked upon with suspicion as tending to create types and general monotony.

Blocks as units—Concrete blocks laid to be effective as units may perform a legitimate aesthetic as well as structural service. Texture and color can be given them. Their danger lies in exaggerated scale and general uniformity. Stone has the advantage of lending itself to cutting and fitting in length and height without consequent economic waste. The manufacture of concrete blocks should be studied with variety of size as well as appropriate scale in mind. Corners and angles should be true, and crude and rock faced surfaces avoided.

Blocks as backing for stucco—This is a legitimate field for the use of concrete blocks. Scale need not be taken into account; neither need such matters as sharpness of corners and angles or crudity of surface. Uneven chipping where blocks are cut approximately to the desired outline presents no obstacle to the perfect finish. Surfaces should be such as to which the stucco will most readily adhere.

Costs and permanence—In a letter from an official of the United States Housing Corporation I find these words:

"We were satisfied that there were certain types which would produce a good practical house at a very moderate cost, but it appeared to us that this could be done only where the same unit was repeated indefinitely, and our belief was that this would produce a deadly monotony"

As to the monotony we have already heard; as to the cost and permanence or durability let me say that there may be cases where permanent houses would be a drawback in a developing community. There would be very little salvage in a wrecked concrete house, while the wrecking would entail almost as much expense as the constructing. Unless a community is well "zoned," buildings of a too permanent nature are an economic waste even though the initial cost may be the same as for a building of less permanent character. Where, as in many of our communities, change is the order of the day, well constructed buildings of a more temporary nature are desirable. Buildings of a temporary nature can be "fire stopped," and made safe for occupancy.

Fireproof Character of Concrete Houses—In the letter above referred to these words appear: "We found that the people who were interested in the concrete house were almost without exception, trying to build every part of the house in concrete, including porches and all the trim." This would seem to me to indicate a deficient sense of humor on the part of the people referred to, as well as defective vision. I will grant that the designs of many architects who never intended to make a joke of their work are such as to be readily translated into concrete and would not lose in the process; but a concrete man with a sense of fitness, I'll call it humor, would not design to effect the translation. I must still warn the enthusiastic against excess; excess of imagination as well as excess in material or some of them may wish to make the door hinges out of concrete after all. Fireproofness, so to speak, and permanence are good qualities, for which it is possible at times to pay too much.

Methods and Means—How to make the house reasonably fireproof, reasonably durable, reasonably attractive and reasonably economical in cost and in upkeep presents a series of problems for the architect and the concrete expert. As an architect I shall receive the findings of the concrete expert and will make such applications of the methods and means presented as may suit the particular case. I will even present the case beforehand to the expert—if it is not already covered, and aid him in his solution. I will even ask him now to present types of floors in structures and finish which are durable, economical, and appropriate to a small house. I will ask the same concerning the roofs, high pitched, low pitched and flat.

There are many problems to be solved in connection with the designs, construction and location of the concrete house and I congratulate the concrete and cement interests that they have enlisted the services of so many serious-minded and enthusiastic men in the quest for the best along these lines. I hope that architects of vision and deep feelings may be called upon to co-operate.

The Robb Engineering Works, Ltd., manufacturers of engines and boilers, Amherst, N. S., announce that Mr. D. W. Robb is retiring from the active management of the company, after being engaged actively and continuously for the past forty-five years in that capacity. Mr. George E. Newill, who succeeds to the management, has had considerable engineering and business experience in Canada and other countries. Mr. D. W. Robb will continue as vice-president on the Board of Directors and will retain his connection with the company in an advisory capacity. The company report that their business is likely to increase through the development of farm tractors and other lines which they are taking up.

The Dominion Tar & Chemical Company, Limited, announce that their address will now be 171 St. James Street, Montreal, where all communications should be sent.

Prominent Engineers Honored by the E.I.C.

Czowski Medals for Most Valuable Contributions to Engineering Literature Awarded to Messrs. Johnson, Duggan and Porter

LORD Shaughnessy and Sir John Kennedy, the dean of the engineering profession in Canada, were presented with gold badges as honorary members of the Engineering Institute of Canada at the final meeting of the season of the Montreal branch on April 29th. These badges are replicas of the badge presented to the Prince of Wales on his visit to Canada, when he consented to become an honorary member of the institute. The presentations were made by Mr. R. A. Ross, the president.

Mr. Walter J. Francis, the chairman, referred to the services rendered to the country by Lord Shaughnessy as head of the C. P. R., also by Sir John Kennedy, whose long and useful life was synonymous with the progress of engineering in Canada.

Lord Shaughnessy and Sir John Kennedy made brief replies, the former remarking that during his association with large engineering enterprises of every description, he had taken the advice of hydraulic, mining, marine and mechanical engineers of every description. "Jointly through this friendly co-operation we have carried out during the last quarter of a century many great engineering works involving the expenditure of many hundred millions of dollars. Generally the work was satisfactorily done. Sometimes there may have been a miss, but we were jointly responsible, and did not blame each other."

Sir John Kennedy recalled the fact that he had assisted at the birth of the Engineering Institute. Looking back over that long history of engineering development and all that had been accomplished by the Institute, he felt very grateful for the honor now conferred upon him.

The Czowski medal for the most valuable contribution to engineering literature of the year was presented to Messrs. Phelps Johnson, G. H. Duggan and Geo. F. Porter for their papers on the "Design and Erection of the Superstructure of the Quebec Bridge", which had been published all over the world, and had been, it was stated, acknowledged by experts on engineering literature as the outstanding engineering publication during the year anywhere in the world. Medals were presented to each of the gentlemen named.

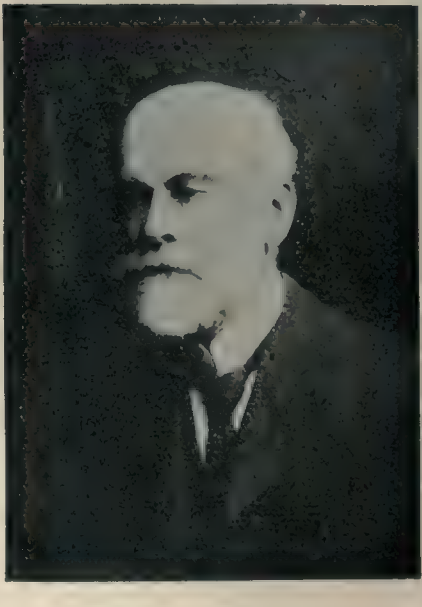
The officers of the branch for the coming year are Chairman, Mr. A. Surveyer; vice-president, Mr. J. H. Hunter; secretary, Mr. J. L. Busfield.

Mr. Walter J. Francis, in his retiring address as chairman of the branch, stated that there had been an unprecedented growth in its work, to such an extent that the meetings had been changed from fortnightly to weekly, with greatly increased membership and attendance.

Summer Meeting of American Institute of Chemical Engineers in Canada

FOR the first time in the history of the American Institute of Chemical Engineers, its annual summer meeting will he held in Canada during the week of June 28th to July 4th. The formal and business sessions of the Institute will be held in Montreal, after which the members of the Institute will proceed to Ottawa by special train, spending one day in Ottawa, where they will be shown several of the large chemical works located there, and the various government bureaus. On Wednesday, June 30th, the party will leave by special train for Belleville, Ontario, and on the following day will be entertained by the City of Belleville, and a motor tour will be made to several of the chemical

Lord Shaughnessy, above, and Sir John Kennedy at the right, who were recipients of gold badges as honorary members of the E. I. C. at recent meeting of Montreal Branch



works situated in Hastings County. A complimentary luncheon will be tendered the Institute by the Deloro Smelting & Refining Co. Limited, at their works at Deloro, Ontario, and the large plant of the Industrial Alcohol Co., Limited, at Corbyville, will also be visited. In the evening a dinner will be tendered the Institute at the Hotel Quinte by the City of Belleville and County of Hastings, at which function several of the leading men in the chemical industries in the United States will be present. On leaving Belleville the party will proceed direct to Shawinigan Falls, Que., where the large electrolytic industries will be inspected. Saturday, July 3, will be spent at LaTuque, inspecting the large sulphate pulp mill of the Brown Company. The party will arrive in New York by special train on Monday, July 5th.

As Canada has abundant resources for the development on a large scale of some of the most important chemical products required in commerce, which have in the past been neglected or not developed to the extent that they should have been, it is to be hoped that the meeting of the Institute in Canada will result in renewed activity along chemical industrial lines. The Canadian members of the Institute are sparing no time to make this meeting an event in the chemical annals of Canada.

Misconceptions on Transportation Matters

Analysis of the Fundamental Facts that Determine the Success or Failure in Transport Business—Water Traffic Specialized—Electrification Not a Panacea — The Motor Truck a Potent Factor

A GREAT deal of misconception exists in the minds of the public and even those of transportation men, as to when and where the different means of transport can be employed to advantage, and even as to different methods of propulsion, states Henry K. Wicksteed in the organ of the Canadian National Railways.

Some thoughtful men, continues Mr. Wicksteed, have been giving much attention to these questions of late, and one of these, Mr. Baker of the Engineering News Record staff, New York, has written some exhaustive and illuminating articles on the subject, and produced a staggering array of facts and figures in contravention of quite commonly accepted ideas.

The principal one of these misconceptions is that waterborne transport is necessarily and essentially cheaper than that by railway. No such sweeping general assumption can be made. In fact, it may be said that the reverse is more often true. The cheapest transport in the world is that on the Great Lakes, but in asserting and drawing deductions from this fact, we must carefully take account of two or three considerations: 1st, the traffic of the Great Lakes is largely specialized, almost entirely so. It consists for the most part of grain in bulk, iron ore, and coal. Ordinarily merchandise cuts a comparatively small figure. 2nd, These commodities move in enormous volume and tonnage and 3rd, the vessel travels on a natural route on which there is nothing to pay for maintenance and upkeep, except at one or two points.

Specialization of Traffic

All these factors have an enormous effect in cheapening the cost of our Great Lakes transport. The specialization for instance, in conjunction with the great volume, has promoted and justified a great expenditure on equally special machinery for loading and unloading. One machine picks up a whole carload and turns it over far enough to dump the contents into a storage bin, from which it drops by gravity into the vessel's hold. The iron ore similarly drops through hoppers in the bottom of the car, and gravity does the rest, almost without any human help or attendance. Grab buckets lift the coal or ore from the vessel's hold at the other terminal, and deposit it in a pile whence it is loaded on the railway cars by a steam shovel as required.

Everyone is familiar with the modern grain elevator, and the extraordinary cheapness of the transfers which it makes, but these appliances cost enormous sums of money, on which interest has to be paid, and it is only the enormous volume of the traffic and its constancy in the one direction, year after year, which makes them practicable from an economic point of view.

It is this specialization, volume, and constancy which are the main factors in effecting the extraordinarily low cost of transport on the Great Lakes, but there is another which is common to ocean traffic. The road has cost nothing except at the Sault Ste. Marie locks and some improved channels. Consequently there are no considerable interest charges to be borne, and the same is true of maintenance and repairs. On a railway, or even a modern highway, these items are a very large proportion of the total cost of transportation, and it is here that one great difference comes in between the water and land transport, but when we go in for artificial channels, canals and locks, and their maintenance and operation, the story becomes quite a different one.

The Welland Canal, for instance, is to cost more than 50 millions; a first class railway for the same distance would cost 3 millions. The difference in interest charges alone at 5½ per cent. is more than 2½ millions per annum.

Will Traffic Justify Expenditure on Waterways?

This huge amount can be justified only by a great volume of traffic. Can we expect that traffic? Time was (I trust it has nearly gone by) when it was considered that interest charges in State transport undertakings should be met by the State and not directly by the traffic. I think it unnecessary to go further into this question here and now. The point is that all these charges have to be met, and sooner or later, directly or indirectly, the community, the ordinary consumer, you and I, have got to pay them, or bankruptcy is the result.

I am very far from singling out the Welland Canal as a special example, or for attack. I am mentioning it because it is at our doors and we understand it best. The New York State barge canal is an even better example. This work has cost something like $150,000,000 and the State is at the present moment "scratching its head" and worrying to find traffic for it. Even in war times, with disorganized and congested railways, there was none to speak of, and the government took to building vessels to ply on it to justify the expenditure on the canal itself. But, it will be answered, "this is only a barge canal." Let us then take another example, the Mississippi and Ohio Navigation. This, only a few years ago, was one of the busiest highways in the world, millions upon millions of tons of coal having been floated down these streams at a ridiculously low cost from Pittsburgh to New Orleans and intermediate points. Low water interfered more or less with the traffic at some times during the year, and the Washington government spent many millions in moveable dams on the Ohio, and in dredging and dyking on the Mississippi.

But in spite of these improvements the water traffic is falling off, and the railways are getting a larger share of it. It may be pointed out that this too is a specialized traffic, and justified larger expenditure for special steel barges, steamers, and for terminal appliances. Also that this traffic went on nearly all the year round, while our northern canals are closed for several months during the winter.

This is a striking illustration of the marked superiority of the railway over the canal in flexibility and speed, and it shows how foolish it is for the public to believe that because a principle can be applied in one case it can be applied with successful results in all others, no matter what the consideration may be.

Railway and Highway go to Origin of Traffic

The railway, and for that matter, the highway, can go direct to the origin of the traffic, while the waterway can not, and the same is true of delivery at the other terminal. Even the lumberman has found this out, and many modern concerns build a light branch into the heart of a bunch of timber, and do their logging at its terminal. In a day or two or even a few hours, the log is being sawed at the mill. Contrast this with the waterborne traffic still being carried on in remote districts. The log is hauled several miles, at times, to the nearest stream. The logging road cost money, and the stream has to be improved and dams built. For months the log lies idle waiting for the spring. Then it starts on its way with a gang of men to look after it. It reaches a larger river or lake and is towed across it. It is "driven" over rapids and falls, and months, sometimes years, elapse before it reaches the mill. Much of the time it has to be watched and tended by skilled workmen, and always the interest on its first cost are running on.

This is somewhat different from the ordinary traffic of a manufacturing district, but the principle is identically the same. The steamer or canal can deliver only at the water front, the railway almost anywhere, and often within the grounds and even under the very roof of the manufacturer's or wholesaler's building.

And this brings me to another factor little understood by the public. We hear a great deal in these days of the cost of transportation, and how it affects the cost of commodities, the H. C. of L. which is in these days ever before us. The absurdity of much of this talk was very plainly brought out recently in the story of the $80 suit of clothes which was brought from Chicago to New York for 16 cents, or 1/5 of 1 per cent. of its selling price. Yet the dealer wanted 10 per cent. advance. There are multitudes of similar absurdities which might be cited.

Transportation is Small Factor in Price of Goods

Transportation is a ridiculously small factor in the price of a majority of the necessities of life. But part of the cost of transportation includes that of distribution to the consumer; the handling, housing and cartage of mixed freight in and through a large city,—terminal charges in fact,—and it is here that the railway has the advantage over the waterway; not only in the way I have pointed out of being able in many cases to put its car under the very roof of the factory or warehouse, and so avoiding double handling and teaming, but, of lessening the actual cost of the single handling. The coal merchant builds a trestle, the locomotive shoves a car on to it, and the coal drops by gravity into his shed, or bin, through a hopper bottom. A carload of flour arrives at a biscuit factory, the car is placed with its floor exactly level with that of the factory, and the load is removed on ordinary trucks and under cover.

Contrast this with the procedure in the case of steamer or barge. Much, if not all of the lading, must be below decks. It must be hoisted up with a windlass above the bulwarks, swung out and lowered on the wharf. Then it is trucked into a shed, and from the shed it is loaded on to a wagon or truck, and taken perhaps several miles to the factory. On the arrival of this truck, there is still as much work to be done to get its load indoors as was involved in the single operation of unloading the box car.

Unloading Lime

There is another feature about this every-day handling which is lost sight of. The steamer can operate cheaply only when loaded to pretty nearly her full capacity, several hundred, or it may be thousands of tons. The operation of unloading this stuff takes time, and the consignee who has 30 tons or so of merchandise must wait until his consignment is uncovered, unloaded and identified, before he can send for it. The box car has come as part of a long train which is broken up in a receiving yard and switched as a single unit to his own particular siding or spur. He consumes this 30 tons of flour or what not in a certain time, which he knows, beforehand and he can count with reasonable certainty on another car coming in when that is used up. This is not nearly so certain in the case of the steamer, which deals in large quantities only with economy, and he must take the large quantity and find means to store it until he can use it, or take his chance of having to shut down his factory while waiting for the next small consignment. From the transportation company's point of view, the difference is this, especially at a port which is only a port of call, not a terminal: The steamer has to wait under steam, and perhaps with a considerable crew under pay, while this particular 30 tons is being sorted out and unloaded. It may be that she comes in at midnight, and the weather is bad, the stuff perishable, and the dock laborers don't want to work. The railway locomotive delivers its car and goes off about other business, and if the car is held a few hours longer in unloading, there is merely a moderate charge for demurrage.

I think it will be evident that for moderate quantities of mixed freight at diverse points, the steamer or barge is out of the running altogether, even when a beneficent Providence, or a paternal government provides the water way free of charge. This is precisely one of the reasons why the large expenditure by the Washington Government on the Mississippi improvement has proved to be unjustifiable.

Large Canal Capacity Sometimes a Disadvantage

That large capacity is often a distinct disadvantage in some cases, has been very well brought out in the history of the New York canals. The Erie was enlarged to 1,000 ton barge capacity because it was obvious that a large craft can do the actual transportation cheaper than a small one, but it was soon found that actual consumers en route, and even in New York could not take care of such large consignments all at once, and preferred deliveries in box car units, even if it cost a trifle (and a very small trifle) more per ton for the actual transfer. Hence some of the transportation companies are reverting to a smaller unit of barge which can be left to unload just as the box car can, while the tug goes off with the rest of its fleet. This is a lesson the railways have taught, and an intensely interesting one, but if the small barge is more useful than the large, where are we to look for justification of the enormous cost of the enlargement of the canal?

The promoters were looking for a great volume of specialized traffic in grain from Buffalo to New York which has not materialized, and shows little sign of materializing in competition with such carriers as the New York Central, the Erie and the Lackawanna.

That the writer should hold such views in the comparison between water and land carriage is the more remarkable, and should perhaps be more convincing to his readers, in that he has been for many years an avowed believer in one of the greatest of the water carriage projects of this continent. He is one yet. At the outset we started by recognizing the paramount importance of the commerce of the Great Lakes, and only less important is the extension of this navigation to the sea—but this is an extension of an already wonderfully successful and growing business, not an attempted revival of antiquated methods of carriage which have signally failed in competition with the new.

Railway Transportation Getting Cheaper

The apparent change has not been so much, if at all, in his own state of mind as in the data from which we must start. Railway transportation 30 years ago was enormously more expensive than it was two or three years back, and the reduction has been to a large extent in this very element of terminal and distribution charges, due to the ability of the railway to throw out spurs and "feelers," searching business in out-of-the-way corners, going after the business instead of waiting for the business to come to it. And it is a remarkable thing that the busiest of our railways are in many cases those that parallel the waterways. The busiest section of the Grand Trunk for instance is probably that between Montreal and Toronto. One of the busiest sections of the C. P. R. is that between Montreal and Quebec. In the United States we have the New York Central paralleling the Hudson River and the Erie Canal for the entire distance from Buffalo to New York. And perhaps most remarkable of all, because it is a north and south road, is the Illinois Central paralleling the Mssissippi for its entire length. The reason is very interesting, and it is that the waterways effected the original settlement, and built up the cities, towns and villages along their banks; and created the potential traffic. The railways in the first place took the passenger and express business, owing to greater speed and punctuality, but the possession of this field made it easier for them to carry freight cheaply just as a man with a fixed income, and not overworked, can afford to do extra work at a lower rate than one who is altogether dependent on it. "Unto him that hath shall be given, etc." This and the flexibility above referred to, as well as their capacity to carry on for twelve months during the year, gradually led to the railways displacing the water carriers in any but long distance and specialized freight. Barges still carry sand into Montreal because they load it from the river bank, but the picturesque "chalons" of the lower St. Lawrence, which used to come in fleets up the river with every fair wind, carrying hay and farm produce have almost disappeared, and even the schooners which used to crowd the Louise basin at Quebec, are getting fewer every year.

There is another misconception in the popular mind as to motive power. "because an electric locomotive does not burn coal, or burns it more economically at a central power house, therefore electricity must of necessity be the cheaper form of propulsion."

Electric Propulsion Not Always Cheapest

This idea is the more difficult to combat, because it is sometimes and partly true. But that it is universally true is a very great fallacy indeed. The ordinary layman sees only the comfortable and cleanly cars speeding along with fifty passengers, and notes that there are only two men on it, and that the power is supplied by Niagara Falls for instance. He does not see the enormous extra cost of the overhead wires and poles, the transforming stations, and the power development, and that the interest on these items has, as in the case of the artificial waterway, to be met day by day, and year by year. He sees this car climbing up grades with its crowd of passengers, such as he never sees on a standard railway, and infers that only electricity can do such things. He does not understand that passenger business is nearly always the least important of a railway's functions, and that for a passenger business alone to pay, it must be very "dense" indeed, such as is only available in cities or their suburbs; that freight business, the larger item by far in railway earnings, is essentially one demanding "trains" of separate units with an external locomotive, capable of being broken up and put together again, and added to or substracted from, and easy grades and long trains are just as essential to economical operation with electric propulsion as with steam. Electricity will gradually replace steam in a great many places, but the process will be, and rightly, only gradual and tentative, not sudden and revolutionary. Here again "density" of tonnage is the key.

Electricity Pays Only in Congested Districts

The most extraordinary fallacy of all, and one that is very common, is that railways through sparsely settled districts, which have been unsuccessful as steam roads, can be immediately made to pay by converting to electricity. It is the congested pieces of road which promise the best result from the change. The electric equipment means more capital, and it is with light traffic that the interests charges are relatively more burdensome, and as the traffic grows, we can afford to make them higher, in order to effect comparatively small economies in fuel consumption and maintenance; in costs per ton mile in fact.

In regard to electric traction, the National Railway has been a pioneer road in the development of this particular type of railway. An important factor in its system is the Niagara, St. Catherines and Toronto, serving the busy industrial district of the Niagara peninsula. This is a case of specialization in a thickly settled country, in conjunction with abnormally cheap power. Another departure is the electrification of the Montreal terminals. This last was largely forced upon the company by the tunnel itself, just as electrification was forced upon the Grand Trunk at Sarnia, and upon the New York Central in New York. In the Montreal case it is physically a perfect success, and financially it will become so when the transmontane traffic grows to the greater proportions which we may reasonably expect. It is quite probable that the electric zone will in time be extended to the suburbs of St. Jerome, and eventually Ottawa. The most promising development for the near future is that of the terminals of the Capital City itself, jointly by all the railways, partly on account of the abundance of power available, partly because of all our cities, Ottawa has the best right to be kept clean, wholesome, and beautiful.

The Motor Truck

A new form of transportation has come into vogue of late with the advent of good highways, and it has come to stay. This is the motor truck. With the very best roads in the world, it is impossible that this can compete for long distance traffic with the railway or the steamer, and there is grave danger that this again will be overdone. Its advocates show the same tendency to overlook the fact that the highway must be built and maintained, and a fair comparison must include its share in these costs, as well as those of the vehicle itself. The motor truck will infalliby wear out with fewer ton miles than the box car or the locomotive, and therefore its amortization charges must be higher. But making due allowance for these limitations, the motor truck and the motor bus are very useful modern developments indeed, and surpass the steam and electric railway in precisely the same respect as the latter surpass the waterborne traffic; in flexibility. The truck can leave the door of one building with its load and in 3 hours can deliver it at another warehouse 50 miles away. The cost of actual transport on the 50 miles will be much higher, but the time saved will be considerable, and where either industry has not a spur track of its own, the cartage and rehandling will be avoided, and the total cost of the transfer may be even less than by the railway. The truck and the motor bus have the further advantage of being able to select their own route. If congestion occurs on one road, they can turn aside, and take another.

But these advantages are quite outweighed when we run into long distances and heavy tonnage. The truck has at least one high-priced man, with perhaps 5 tons behind him. The railway train will have 5 men with 2,000 tons or 400 tons to each. Even conceding that the speeds would be approximately equal, the discrepancy in wages is enormous, and easily apparent. It is the same question again of terminal charges and distribution after arrival at destination, which in the case of a short haul may more than outweigh the saving in actual movement.

It was announced recently that the Hudson Bay Company contemplate the erection of a $5,000,000 store soon in Winnipeg.

New York Recognizes Value of Hydrated Lime by Permitting its Use in Concrete

An important and far-reaching decision is expressed in the ruling recently made by the Board of Standards and Appeals of New York York City in regard to the use of hydrated lime in concrete mixtures. Many experienced engineers and contractors have long felt that the building codes of all our cities should officially recognize the value of admixtures of hydrated lime in concrete construction, the practical value of which has been repeatedly demonstrated by results in the field.

This matter came before the Greater New York Board as an appeal for a ruling touching the specification for hydrated lime in the concrete work on a large building in that city. After holding numerous hearings and securing testimony from all available sources the Board adopted the following ruling:

"The use of hydrated lime in all classes of concrete construction shall not be prohibited when used in accordance with the conditions hereinafter set forth.

"The hydrated lime shall conform with the Standard Specifications for this material which have been adopted by the American Society for Testing Materials.

"The maximum amount of hydrated lime which may be used shall conform with the following table, all weights given being the amount of lime which may be incorporated for each ninety-five pound bag of portland cement used.

1-1½-3 mix: 4 pounds of hydrated lime per bag of cement
1-2 -4 mix: 5 pounds of hydrated lime per bag of cement
1-2½-5 mix: 6 pounds of hydrated lime per bag of cement

"For hand mixed concrete, the hydrated lime and portland cement shall be well mixed while dry.

"Hydrated lime shall not be used in concrete which is to be deposited under water."

This decision is a clear-cut recognition, from an authoritative source, of the fact that the addition of hydrated lime in general concrete construction has definite advantages for certain purposes.

Comprehensive Working Agreement Between Montreal Master Plumbers and Plumbers' Section of Workers' Syndicate

The Master Plumbers' Association of Montreal and the plumbers' section of the Catholic and National Workers' Syndicate have signed an agreement as to wages and working conditions. The chief features of the agreement are a working week of forty-nine or fifty hours during the summer months, and a forty-four hour week during the winter; the classification of journeymen plumbers and steamfitters into three grades according to their competence and experience, with different rates of pay obtaining in each grade; full recognition of the principle of the "open shop," and a declaration that the members of the Master Plumbers' Association will refrain from sympathetic lockouts and the journeymen from sympathetic strikes because of trouble in any one of the other building trades. Differences of opinion as to the interpretation to be put on the various clauses of the agreement and the manner of carrying its provisions into effect are to be adjusted by a standing joint arbitration committee composed of not less than three and not more than five members nominated by each party to the agreement. The questions of wages and hours of work have by mutual consent, however, been withdrawn from the scope of the work of the committee.

Concrete Block and Tile House Construction

Recommended Practices—Specifications and Building Regulations — Protection Against Moisture

IN the development of a code of recommended practices for concrete block and tile house construction a committee on this subject reported to the National Conference on Concrete House Construction that the following points should be considered:

1. Specifications and building regulations for concrete block and tile.
2. The composition, preparation and use of cement mortars.
3. Types of mortar joints and approved thicknesses.
4. Water-proofing of foundation walls below grade.
5. The use of split sills and lintels.
6. Suggestions for protecting sills, lintels and other projecting portions from breakage and spattering during construction.
7. Methods of cleaning the walls.
8. Plastering with or without furring and lathing.

Specifications and Building Regulations

Concrete block and tile used in house construction should meet the requirements of the standard specifications and building regulations adopted by the American Concrete Institute, and as these may be amended from time to time. These are as follows:

1. Concrete architectural stone, building block and tile for solid or hollow walls and concrete brick made in accordance with the following specifications and meeting the requirements thereof may be used in building construction.

2. **Tests.**—Concrete architectural stone, building block for hollow and solid walls and concrete brick must be subjected to (a) Compression and (b) Absorption tests. All tests must be made in a testing laboratory of recognized standing.

3. **Ultimate compressive strength.**—(a) In the case of solid stone, block and brick, the ultimate compressive strength at 28 days must average not less than 1,500 lb. per sq. in. of gross cross-sectional area of the stone as used in the wall and must not fall below 1,000 lb. per sq. in. in any test.

(b) The ultimate compressive strength of hollow and two-piece building block at 28 days must average 1,000 lb. per sq. in. of gross cross-sectional area of the block as used in the wall, and must not fall below 700 lb. per sq. in. in any test.

4. **Gross cross-sectional areas.**—(a) The cross-sectional area of solid concrete stone, block and brick, shall be considered as the minimum area in compression.

(b) In the case of hollow building block, the gross cross-sectional area shall be considered as the product of the length by the width of the block. No allowance shall be made for the air space of the block

(c) In the case of two-piece building block, if only one block is tested at a time, the gross cross-sectional area shall be regarded as the product of the length of the block by one-half of the width of the wall for which the block is intended. If two blocks are tested together, then the gross cross-sectional area shall be regarded as the product of the length of the block by the full width of the wall for which the block is intended.

5. **Absorption.**—The absorption at 28 days (being the weight of the water absorbed divided by the weight of the dry sample) must not exceed 10 per cent. when tested as hereinafter specified.

6. **Samples.**—At least six samples must be provided for the purpose of testing. Such samples must represent the ordinary commercial product. In cases where the material is made and used in special shapes and forms too large for testing in the ordinary machine, smaller specimens shall be used as may be directed. Wherever possible the tests shall be made on full sized samples.

7. **Compression tests.**—Compression tests shall be made as follows: The samples to be tested must be carefully measured and then bedded in plaster of paris or other cementitious material in order to secure uniform bearing in the testing machine. It shall then be loaded to failure. The compressive strength in pounds per square inch of gross cross-sectional area shall be regarded as the quotient obtained by dividing the total applied load in pounds by the gross cross-sectional area, which area shall be expressed in square inches computed according to article 4.

When such tests must be made on cut sections of block, the pieces of the block must first be carefully measured. The samples shall then be bedded to secure uniform bearing, and loaded to failure. In this case, however, the compressive strength in pounds per square inch of net area must be obtained and the net area shall be regarded as the minimum bearing area in compression. The average of the compressive strength of the two portions of block shall be regarded as the compressive strength of the samples submitted. This net compressive strength shall then be reduced to compressive strength in pounds per square inch of gross cross-sectional area as follows:

The net area of a full sized block shall be carefully calculated and the total compressive strength of the block will be obtained by multiplying this area by the net compressive strength obtained above. This total gross compressive strength shall be divided by the gross cross-sectional area as figured by article 4 to obtain the compressive strength in pounds per square inch of gross cross-sectional area.

When testing other than rectangular block, great care must be taken to apply the load at the centre of gravity of the specimen.

8. **Absorption tests.**—The sample shall be first thoroughly dried to a constant weight at a temperature not to exceed 212 deg. F., and the weight recorded. After drying, the sample shall be immersed in clean water for a period of forty-eight hours. The sample shall then be removed, the surface water wiped off, and the sample re-weighed. The percentage of absorption shall be regarded as the weight of the water absorbed divided by the weight of the dry sample multiplied by 100.

9. **Limit of Loading.**—(a) The load of any hollow walls of concrete block, including the superim-

posed weight of the wall, shall not exceed 167 lb. per sq. in. of gross area. If the floor loads are carried on girders or joists resting on cement pilasters filled in place with slush concrete mixed in proportion of one part cement, not to exceed two parts of sand and four parts of gravel or crushed stone, said pilasters may be loaded not to exceed 300 lb. per sq. in. of gross cross-sectional area.

(b) Solid walls built of architectural stone, block or brick and laid in portland cement mortar or hollow block walls filled with concrete shall not be loaded to exceed 300 lb. per sq. in. of gross cross-sectional area.

10. **Girders and joists.**—Wherever girders or joists rest upon walls in such a manner as to cause concentrated loads of over 4,000 lbs., the block supporting the girders or joists must be made solid for at least 8 in. from the inside face of the wall, except where a suitable bearing plate is provided to distribute the load over a sufficient area to reduce the stress so that it will conform to the requirements of article 9.

When the combined live and dead floor loads exceed 60 lb. per sq. in., the floor joists shall rest on a steel plate not less than three-eighths of an inch thick and of a width one-half to one inch less than the wall thickness. In lieu of said steel plate the joists may rest on a solid block which may be 3 or 4 in. less in wall thickness than the building wall, except in instances where the wall is 8 in. thick, in which cases the solid block shall be the same thickness as the building wall.

11. **Thickness of walls.**—(a) Thickness of bearing wall shall be such as will conform to the limit of loading given in article 9. In no instance shall bearing walls be less than 8 in. thick. Hollow walls, 8 in. thick, shall not be over 16 ft. high for one story or more than a total of 24 ft. for two stories.

(b) Walls of residences and buildings commonly known as apartment buildings not exceeding four stories in height, in which the dead floor load does not exceed 60 lb. or the live load 60 lb. per sq. ft., shall have a minimum thickness in inches as shown in Table 1.

Table 1

No of Stories	Basement	First Story in.	Second Story in.	Third Story in.	Fourth Story in.
1	8	8	..	..	..
2	10	8	8	..	..
3	12	12	10	8	..
4	16	12	12	10	8

12. **Variation in thickness of walls.**—(a) Wherever walls are decreased in thickness the top course of the thicker wall shall afford a solid bearing for the webs or walls of the course of the concrete block above.

13. **Bond and bearing walls.**—Where the face wall is constructed of both hollow concrete block and brick, the facing shall be bonded into the backing, either with headers projecting 4 in. into the brick work, every fourth course being a header course, or with approved ties, no brick backing to be less than 8 in. thick. Where the walls are made entirely of concrete block, but where said block have not the same width as the wall, every fifth course shall overlap the course below by not less than 4 in. unless the wall system alternates the cross bond through the wall in each course.

14. **Curtain walls.**—For curtain walls the limit of loading shall be the same as given in article 9. In no instance shall curtain walls be less than 8 in. in thickness.

15. **Party walls.**—Walls of hollow concrete block used in the construction of party walls shall be filled in place with concrete in the proportion and manner described in article 9.

16. **Partition walls.**—Hollow partition walls of concrete block may be of the same thickness as required in hollow tile, terra cotta or plaster block for like purposes.

Mortars

Unless carefully made, mortar joints are likely to be the weakest portion of a concrete block or tile wall. The essentials of a good mortar joint are:

1. It should be dense and non-absorbent.
2. It must have a sufficient compressive strength to withstand pressure in the wall without crushing.
3. It must attain strength rapidly.
4. It must be reasonable in cost and easily obtainable.
5. It must possess good working qualities.
6. It should look satisfactory.
7. It should endure permanently.

Portland cement mortar meets these requirements and should be specified for concrete block and tile wall construction. The ingredients of portland cement mortar are portland cement, sand and water. Usually a limited amount of hydrated or well-slaked lime is included.

Proportions

Among masons there is a wide variation in the ratio of cement and sand used in making mortar; some prefer as rich a mixture as equal parts of cement and sand, while others use a mortar containing three times as much sand as cement. A proportion of one sack of cement to two cubic feet of sand will be found satisfactory under most conditions. A mixture containing in excess of three cubic feet of sand for each sack of cement is not recommended. Hydrated or slaked lime may be added to the mortar in an amount not to exceed 25 per cent. by volume of the amount of cement in the mixture.

Mixing

The usual method is to mix the cement and sand dry until the resulting mixture is uniform in color and of like character throughout. Hydrated lime may be incorporated in the mixture simultaneously with the cement and sand. When lime putty (slaked lime) is used it is customary to dissolve the putty to a creamy consistency in water and then use this lime water when mixing the mortar. The mortar may be either mixed by hand or by mechanical means. In most cases hand mixing is practiced as the workmen can readily tell when the mass has required the proper consistency to obtain the best working qualities. Only as much water should be added as will after thorough mixing, produce a mixture of such plasticity as will work to best advantage.

It is best to mix only a small batch of mortar at a time (say enough for 30 minutes work). Mortar which has stiffened must not be remixed with water to impart to it workable qualities again. This process is commonly referred to as "retempering." It should not be permitted.

Mortar Colors

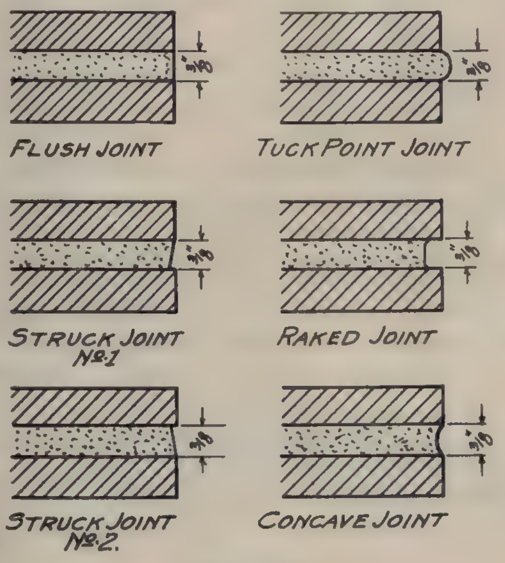
Colored mortars have never become very popular. For high-class structures the natural cement colors have been preferred. None but finely ground mineral colors should be used for making colored mortars. The amount which may be used should never exceed 10 per cent. by weight of the cement in the mixture.

Extreme care should be taken that successive batches of mortar contain exactly the same proportions of cement, sand, coloring matter and water, otherwise the mortar will not be uniform in color.

Mortar Joints

Mortar joints, both horizontal and vertical, should average ⅜ in. in thickness. In no instance should the joint be less than ¼ in. thick. A good bond between the mortar and the block is essential. To accomplish this end, mortar should be applied with force. For best results both ends of the block should be buttered. The horizontal or supporting section of the block should be entirely covered with mortar. Quite a number of styles of joints are in common use. Among these are: Flush joint, struck joint No. 1, struck joint No. 2, concave joint, tuck point joint.

The flush joint, as its name implies, is made by striking the mortar off flush with the wall surface. Except where the block are to be covered with stucco, the flush joint is not recommended because of its porousness and openness.



Types of joints

Struck joint No. 1 is made by drawing the trowel along the joint with the blade resting on the edge of the block below the joint. In making struck joint No. 2 the operation is the same as for No. 1 except that the blade of the trowel glides on the edge of the block above the joint. The latter is preferable because it provides a more weatherproof joint. It is often called a weather joint.

The concave joint is made by drawing a pointing tool along the joint producing a concave surface. This operation compacts the mortar producing a dense watertight joint. It is the type of joint recommended as most practical for concrete block houses which are not intended to receive a stucco finish.

The tuck point joint is seldom used and is not recommended. This joint is formed by a special tool producing a joint which projects beyond the wall surface.

Waterproofing the Foundation

A dry basement is one of the requirements of good construction. When the sides on which the house is to be located does not have good natural drainage it is best to waterproof the outsides of the walls below grade. No matter how much care is exercised in making concrete block or placing them in the wall it is not always possible to obtain absolutely watertight construction.

The simplest method of waterproofing is to paint the wall with hot pitch or asphalt. When this method is adopted the precaution must be taken to have the wall dry as these materials will not adhere to a moist surface. Lines of drain tile should be laid around both the outside of the wall footings and at least 6 inches below them to carry off excess water. These tiles should be connected to a suitable outlet drain.

Sills and Lintels

To make sure that no moisture penetrates the walls at the sills, lintels, sill courses, lintel courses and joists courses and to prevent condensation on the inside walls at these places, all building trim should be of two-piece construction so as to provide an air space between the inner and outer sections. The space between the inner and outer sections need not be greater than ¼ in.; a continuous air space is all that is required. Each division of lintel should be reinforced according to standard methods to carry the superimposed load.

Protection of Sills and Lintels and Other Ornamental Trim

Much of the beauty of ornamental concrete trim may be easily discounted by damage during construction. Adequate protection for these parts should be provided. A covering of building paper is often used. Where the trim is exposed to unusual danger it should be boxed in.

Another factor which contributes to making a structure attractive is clean walls. Workmen should be cautioned to be reasonably careful not to spatter the walls during erection. Any mortar which becomes attached to the block surface should be removed before the masons leave the job.

When the mortar has become firmly bonded to the wall surface it may be necessary to remove it with an acid solution. Muriatic acid diluted with water as required should be used for the purpose. This solution is usually applied with a stiff brush or broom. When the mortar has been removed, the acid must be immediately washed off the wall by scrubbing or flushing with water.

Plastering on Block With or Without Furring

Some concrete block enthusiasts have recommended that plaster be applied directly to the block surface. These recommendations have been made despite the fact that it is customary to furr out the plaster for all kinds of masonry houses. Furring and lathing costs only a trifle more when considering the total cost of the house and it assures a warmer wall. The better insulation thus provided effects a considerable saving in the winter coal bills and provides a house which is cool in summer. In no case shall plaster be applied directly on the concrete surface unless the house is constructed according to the following specifications:

The wall shall be constructed of two-piece block providing a continuous air space from the footing to the eaves and entirely around the building. All sills and lintels shall be of the two-piece type and the inner and outer sections shall be separated so as to provide a clear air space between them. The outside of the foundation below grade shall be waterproofed as hereinbefore specified.

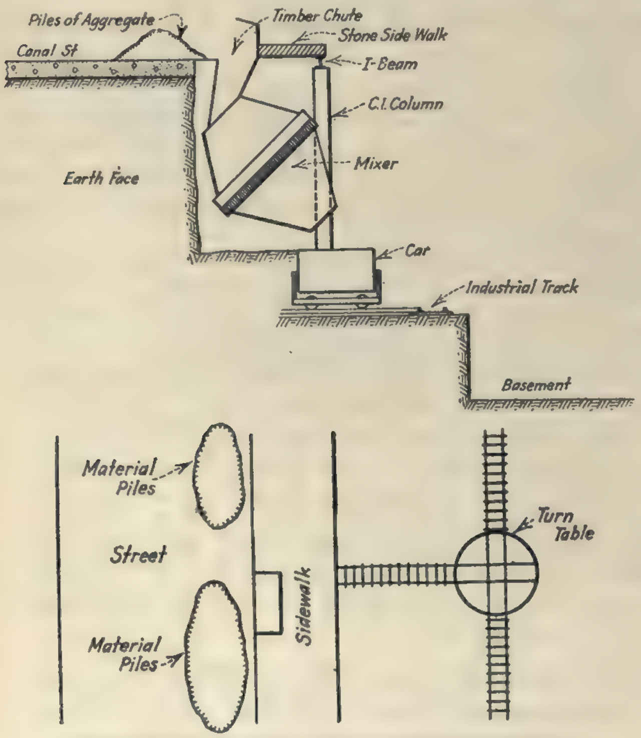
Hints for the Contractor

That May Save Him Time and Money—We Will Pay for All Accepted Items—Send One In

Concrete Plant Under Sidewalk

THE accompanying diagrams from "Successful Methods," show how part of the concrete for the foundation walls of the new Union Station in Chicago was mixed and handled. Materials were piled in Canal St. and an electrically driven mixer was placed under the flagstone sidewalk, which was supported by an I beam resting on cast iron columns. A hole was cut in the sidewalk near the curb and a timber chute built from the hole to the mixer. Aggregate was proportioned by wheelbarrow loads, wheeled only a few feet and dumped down the chute into the mixer.

Industrial track was laid around the excavation about halfway between the ground elevation and basement level and a turntable was placed opposite the mixer. When filled, the cars were pushed out, turned and delivered to wherever the concrete was being poured. Here the cars were dumped, the concrete going down another wooden chute to the forms.



Concrete mixer beneath sidewalk facilitates operations

A large volume of cement was handled economically in this way, as gravity did a large part of the moving.

Use of Lag Screws in Trestle Construction

THE Committee on Wooden Bridges and Trestles of the American Railway Engineering Association has the following items in its annual report, which it recommends for inclusion in the "Manual" of the association:

(a) Lag screws require greater care than ordinary bolts and nuts to properly install, but are cheaper on account of ease of application.

(b) Lag screws, where properly applied, hold ties from bunching equally as well as bolts and nuts, and better than daps, in guard timbers.

(c) If the lag screws are tightened after timber has shrunk, there is less cost of maintenance than with bolts and nuts.

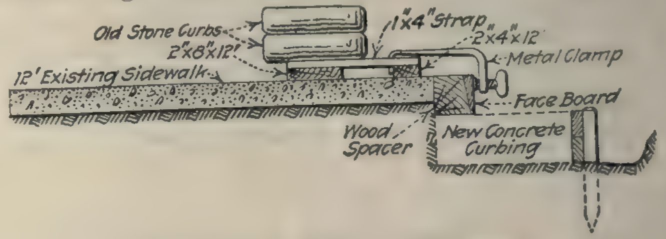
(d) Use of lag screws renders unnecessary the dapping of guard timbers, and, therefore, decreases cost of trestles without impairing quality.

(e) Surfacing (sizing) ties and guard timbers is better construction than dapping; makes a better riding track, thus decreasing impact stresses, and is, therefore, good practice.

(f) For proper application of lag screws, holes in guard timbers should be bored with auger bits 1/16 in. less in diameter and holes in ties ¼ in. less in diameter than the normal size of lag screws used.

Hanging Forms for Curb Work

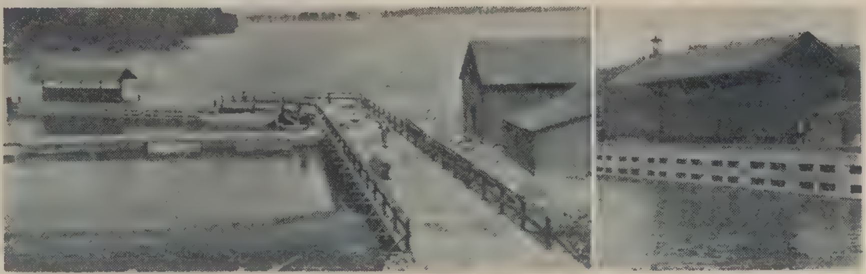
ON a recent contract for concrete curbing work the contractor was required to remove an old flagstone curb joining a 12-ft. sidewalk, making it impossible to stake the back forms, writes D. H. Fleming, town engineer, Owen Sound, Ont., in Engineering News-Record. He therefore laid a plank along the sidewak, near the edge, and weighted it with the old flagstones. The forms were clamped to this strip as shown in the sketch. The method proved very convenient and economical as the back form was not then required and the flagstone weights were close at hand.



Section showing method of holding forms

Montreal Contractors Are Busy

THE improvement in building in Montreal continues. The permits for April totalled $2,858,165, a gain of $2,411,695 over the corresponding month in 1919, while for the four months the total was $4,417,651, an increase of $3,531,079. Montreal contractors have a considerable amount of work outside the city, the latest including the building of the Fraser Memorial Hospital at Fredericton, N.B., by the George A. Fuller Company, Limited, and one hundred houses at Sherbrooke by E. G. M. Cape, Limited. The latter firm have also the contract for the new factory of the Canadian Connecticut Cotton Mills, Limited, at Sherbrooke, Quebec, while D. G. Loomis and Sons have the general contract for



Type of Crib Wharf used on Rideau Lakes, Ont., is cheap, attractive and easy to frame.

the construction work in connection with the St. Margaret's Bay power development of the Nova Scotia Power Commission. Fraser Brace and Company will build the waterworks system for Grand'Mere, P. Q.

Crib Wharf at Portland, Ont., Resists Ice Jams

By A. Langlois, B.A.Sc., C.E.

A CRIB wharf of a design not often used in this country was built at Portland, Ontario, by the Department of Public Works of Canada, during the winter of 1914-15. The design of this crib, cuts of which are shown, may have been open to criticism to a certain extent, on account of the possibility of damage by ice. Portland is on the south shore of the Rideau lakes, at which point the clear water space between the lake shores is about three miles and fear of ice jams against the wharf, pressed by the north wind, might have been entertained resulting in damage by reason of its method of construction. The water of the lake freezes to a depth of about four feet.

This wharf has now been in use for five years and not the least damage has been yet done to the face timbers by the ice, aside from a settlement hardly amounting to a couple of inches. The method employed in the design of such crib works has the advantage of being somewhat cheaper than the close face. The appearance is much ahead of the close face type and the framing of the crib does not present any more difficulties, the only attention to be given being in the joining of the cross ties with the longitudinals, which, of course, have to be the same all through.

The wharf was built by the Department by day labor, the writer having had charge of the design and construction.

National Highway Traffic Association

The annual meeting of the National Highway Traffic Association will be held at the Automobile Club of America, New York City, on Thursday, May 13th, 1920. Nelson P. Lewis, chief engineer of the Board of Estimate and Apportionment of New York City, will speak on the topic "The Effect of the Motor Vehicle upon the Planning of Streets." T. A. Aspell, manager, Truck Tire Sales Department. B. F. Goodrich Rubber Company, Akron, Ohio, will deliver a paper on the topic "Relation of Solid and Pneumatic Tires to Efficient Highway Transport," and H. Eltinge Breed, consulting highway engineer, New York City, will address the meeting on the topic "Relation of Tractor and Trailer Traffic to Highway Design."

Trade Publications

The new edition of the B-T Barn Book has just been issued by Beatty Bros. Ltd., Fergus, Ont. This book, which is looked upon by Canadian farmers as almost a text book on the subject of planning, designing and equipping barns and other farm structures, contains 352 pages replete with information of all kinds relating to barn design and equipment. It is an accumulation of the best information and illustrations on this topic, bound in such a way as to form a permanent work of reference and it is very clearly indexed with this idea in view. We understand it will be sent free of charge to any farmer writing to the nearest branch of the firm.

The National Boiler Insurance Company, Manchester, England, have issued a little booklet entitled, "Notes on Gas and Oil Engine Accidents." The booklet describes the most frequently occurring failures and gives hints for their prevention; price 1 shilling.

The Canada Wire and Cable Co., Ltd., Toronto, have issued an illustrated booklet descriptive of their wire rope and fittings. This gives a short, concise description of wire rope, its use, methods of manufacture, material used, various types of construction and other information. There is a particularly useful chapter on the "Care of Wire Rope." Users of wire rope will find the booklet of great value.

Mainly Constructional

East and West—From Coast to Coast

Mr. F. V. Dowd has been appointed assistant superintendent of sewers at Montreal.

The sum of $108,000 has been added to the civic expenditures at Regina for extensions to the city's sewer and water mains.

The total value of building permits issued by the Building Department of York Township, Ont., during the month of April was $538,150.

Building permits issued at Montreal for the first four months of 1920 totalled $4,417,651, as compared with $886,572 in the same period last year.

Mr. S. J. Taylor, of Regina, has purchased the Inter-Ocean Pressed Brick Company's plant at Pilot Butte, Sask. The new owner will make several additions to the present plant.

At a recent meeting of the Montreal branch of the Engineering Institute of Canada, the Czowski medal for the most valuable contribution to engineering literature during the year was presented to each of the following: Messrs.

Phelps Johnson, G. H. Duggan and George F. Porter, as the joint authors of a brochure on "The Design, Manufacture and Erection of the Superstructure of the Quebec Bridge."

It is announced that the plant of the Canadian Steel Foundries of Welland, Ont., will re-open in the very near future after being closed down for about a year. About 300 men will be employed at the commencement of operations.

Loss sustained by fire in London, Ont., so far this year is estimated by Fire Chief John Aitken at $300,000. The total loss from this cause for the whole of 1919 was only $92,000.

Permits totalling in value $160,770 were issued at Kitchener, Ont., during the month of April. Last year's total for the same month was $58,405. The total value of permits issued during the first four months of the present year was $501,660.

The town of Brockville, Ont., has entered into an agreement with Mr. W. H. Wood, the present owner of the brick plant in the town, whereby the corporation will take over the manufacture of brick and will retain Mr. Wood at a salary to manage the plant.

The City Architect's Department at Toronto, issued permits during the month of April which totalled $2,138,025 in value. This figure establishes a record for any month of April in the history of the department and shows an advance of $517,079 over the corresponding month last year.

It was recently claimed by Professor J. W. Dorsey, of the University of Manitoba that he had discovered a means of heating houses by electricity which would do away with considerable expense in construction by eliminating the cost of expensive material and details for cold prevention. No particulars of his scheme are available at the present time as he is preparing to obtain patents. Professor Dorsey expects to have dwellings erected this year to demonstrate the efficiency and value of his invention.

The first plant in Canada for the mining of magnesite will be in operation soon, and will be located a short distance from Grenville, Que., according to statements made by Mr. T. L. Dates, manager of the newly organized Scottish-Canadian Magnesite Company. Prior to 1914 the steel industry was supplied with magnesite from Austria, and even at the present time there is but one other plant on the continent, it being located in the State of Washington, D. C. Mr. J. M. Kilborne, vice-president of the Canada Cement Company, controls the enterprise with a ninety-per cent. interest in the new company.

Personal

Mr. D. H. Fleming, town engineer of Owen Sound, Ont., has moved into his new office in the City Hall.

The firm of R. H. Miner, builders supplies, has removed from the Coristine Building to 207 St. James St., Montreal.

At a recent meeting of the Board of Trade of Port Arthur, Ont., Mr. T. N. Andrew was elected president by acclamation.

The Civil Service Commission has appointed Mr. A. P. Miller, a returned man, to the position of assistant engineer on the Trent Valley Canal.

Douglas Bremner and Company, Limited, engineers and contractors, have removed from the New Birks Building to 65 McGill College Ave., Montreal.

Mr. F. O. Condon, district engineer of the C. N. R., at Moncton, N. B., arrived home recently after spending the winter in Cuba for the benefit of his health.

W. F. Sparling Co., Ltd., architects, engineers and general contractors, of Toronto, have removed their offices from 120 Bay St. to 54 and 56 University Avenue.

Messrs. W. H. Knowlton & Son Co., Ltd., dealers in contractors' supplies, paving brick, etc., Toronto, have removed their offices from the Kent Building, to room 32, 34 Victoria St.

Mr. Philip Earnshaw has been appointed instructor of civil engineering at the Royal Military College, Kingston, by the Civil Service Commission. Mr. Earnshaw is a returned soldier.

Major E. G. M. Cape, D.S.O., president of E. G. M. Cape Ltd., Montreal, has been appointed officer commanding the 2nd Brigade, 2nd Montreal Regiment, Canadian Artillery, for reorganization.

Mr. W. M. Scott, consulting engineer of the Public Utilities Commission, Brandon, Ont., has been engaged by the city council to make a survey of the water works distribution system in that city.

Mr. Fred Dummitt, recently connected with W. H. Barrie, architect, of Peterborough, Ont., and Mr. Harold Ephgrave, recently of the firm of Ephgrave and Barrett, of the same city, have formed a partnership and will carry on the business of building contractors in the above city.

The firm of Booker and McKechnie, Montreal, has ceased to exist. Mr. McKechnie is now associated with Mr. MacLaren, the firm being known as MacLaren and McKechnie, manufacturers agents. They represent several firms and are the Canadian sales agents of the Arctic water meter.

Mr. W. G. Chace has resigned from the position of chief engineer of the Greater Winnipeg Water Board, the affairs of the Board being now in such a shape as to no longer require his services. His resignation will take effect on June 30. Mr. Chace had complete charge of the construction of the Greater Winnipeg aqueduct. Mr. J. G. Harvey, K.C., solicitor of the Board, is also leaving.

Obituary

Mr. J. W. Lynch, general superintendent of Canadian Allis Chalmers, Rockfield, Montreal, died on May 5th, in Montreal, as the result of heart failure, following an attack of pneumonia.

Mr. Thos. Black, prominent contractor of Hull, Que., died recently in his 68th year, following a four-day illness from pleuro-pneumonia. Mr. Black served as alderman on the Hull City Council for 14 years.

Trade Incorporations

Mount Royal Housing Company, with head office at Montreal, capital $500,000.

Lundy Dustless Street Sweepers, Limited, with head office at Brantford, capital $225,000.

The John Wardrop Brick & Tile Company, Ltd., with head office at Winnipeg, Man., capital $100,000.

Reliance Lumber & Builders' Supplies, Limited, with head office at Toronto, capital $40,000.

Consolidated Sand & Supply Company, Ltd., with head office at Montreal, capital $1,000,000, to deal in sand, rock, stone, etc.

The D'Arcy Engineering Company, Limited, with head office at Montreal, capital $50,000, to carry on a general engineering business.

Caledon Brick Company, Limited, with head office at Toronto, capital $100,000, to deal in brick, tile, slate, artificial stone, and building materials.

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Industrial Housing Proves Profitable Investment by Stabilizing Labor

THE scarcity of house accommodation and the disinclination of capitalists to invest money in building has compelled many industrial companies to undertake housing schemes. The pulp and paper companies were the pioneers in this direction. That industry has expanded at a great rate; new plants, particularly in the province of Quebec, have been established in various localities, and in connection with nearly all of them the companies were faced with the problem of housing the thousands of men attracted to this prosperous industry.

Some of the plants have been constructed in districts which afforded practically no housing accommodation; the location of these plants being governed by the question of abundant and cheap hydro electric power and supplies of raw material. The companies were, therefore, bound to build the necessary houses, for it is obvious that it is of no use constructing a big mill and engaging hundreds of men without making provision for their housing. In some places, like Three Rivers, the existing number of houses was quite inadequate to meet the demands resulting from the expansion of the industry. Thus we find that the companies have built and are building houses to suit the requirements of their employees.

This example has been followed by other industrial concerns, especially in the eastern townships of Quebec, where a number of branch plants of American concerns are being constructed. These branches are generally located in towns where there is a supply of cheap power.

From the companies' point of view, the construction of such houses is a profitable investment. With ample capital at their command, these companies are able to acquire lots and to build houses with central heating systems, which are suitable and which in many respects are more substantial, attractive and commodious than buildings put up by private owners. The return, while it may be smaller than is generally expected by such owners, is made up for by the fact that the housing scheme tends to retain men in continuous employment, thus making for efficiency. In this era of industrial unrest employees are liable to leave their jobs on a very slight pretext. The fact, however, that they are comfortably housed at a comparatively small rent, is likely to exert a strong influence in determining whether the men will be susceptible to the doctrines of unrest and discontentment. Good housing is, of course, not the sole factor in such circumstances, but none can doubt that it has a strong bearing on the subject. The fact, too, that so many companies are spending hundreds of thousands of dollars in good housing schemes is significant of the trend of opinion of directors of industrial concerns, who doubtless view the expenditure as beneficial both to the employees and to the companies.

American Water Works Association's Program for Montreal Meeting

FOR the first time in 13 years, the American Water Works Association this year will hold its annual convention in Canada. The Windsor Hotel, Montreal, has been selected as headquarters. The association will have the exclusive use of a quiet and roomy convention hall, a large exhibit room and comfortable lobbies. Arrangements have been made with the customs department for admitting exhibits from the United States duty free, and for the entrance of automobiles without undue trouble.

Following the past hard winter, opportunity will be afforded the members of the association to become familiar with the design and operation of water works to meet conditions due to prolonged very cold weather, a subject interesting to most members at this time. It will also give the association's United States members an opportunity to study on the spot methods of management due to Canadian conditions, differing from those governing similar administrative work in some parts of the United States, and likely to afford much valuable information to superintendents from the United States who have not previously visited Canadian water works.

Following is the tentative programme announced by the executive committee of the association:—

Monday, June 21st

Registration, meetings of executive and other committees, and informal "get acquainted" meetings in lobbies and exhibit room.

Evening—

Informal reception arranged by the local committee and the Water Works Manufacturers' Association at the Windsor Hotel. Dancing.

Tuesday, June 22nd

Forenoon—

Opening of convention in the Convention Hall, at 9 o'clock.

Reading of papers, as follows:—

"The Municipal Water Supply of Montreal," by Thomas W. LeSage.

"The Works of the Montreal Water and Power Company," by F. H. Pitcher.

"The Experience in Montreal in the Manufacture of Alum," by James O. Meadows.

Afternoon—

"The Water Works of the City of Quebec," by Arthur Surveyer.

"Water Supply Problems in the Province of Quebec," by T. J. Lafreniere.

"The Water Works of St. John, N.B.," by Frank A. Barbour.

Evening—

"Water Works Experiences," by Beekman C. Little.

"Economic Features of Pumping Station Operation," by Leonard C. Day.

"Difficulties in Building the Louisville Pumping Station," by James B. Wilson.

Wednesday, June 23rd

Forenoon—

"The New Water Supply of Winnipeg," by James H. Fuertes and William G. Chase.

President's address, by President Carleton E. Davis.

Reports from sections.

Report of the association's representatives on the American Electrolysis Committee.

Report of the Committee on Private Fire Protection Services (Nicholas S. Hill, chairman).

Report of the Committee on Official Standards for Water Analysis (Jack J. Hinman, Jr., chairman).

Report of the committee on Standard Specifications for Cast-Iron Pipe and Specials (Frank A. Barbour, chairman).

Report of the Committee on Cold Weather Troubles (Charles R. Bettes, chairman).

Reports of officers and standing committees.

Nomination of members of the Nominating Committee.

Selection of place for holding the 1921 convention.

Afternoon—

Entertainment by the Water Works Manufacturers' Association; probably a trip through the rapids of the St. Lawrence River.

Evening—

A smoker for the men, given by the Water Works Manufacturers' Association; and for the ladies, a theatre or card party.

Thursday, June 24th (Superintendents' Day)

Forenoon—

Discussion of the selection, installation, reading and maintenance of water meters. The discussion will be opened by several papers on the subject by members of the association.

The chemical and bacteriological section is preparing a program for a separate meeting, at which a paper will be read by Col. George A. Johnson, on the quality of water. Other subjects and papers for this sectional meeting will be announced later.

Afternoon—

A general discussion of the legitimate uses of water, what they are and how to estimate them. There has been much discussion on water waste and how to prevent it, but up to the present time little on its legitimate use. Some cities have been criticized because of the high per capita consumption without knowledge of the legitimate uses of water in those particular places. The discussion will embrace private sources of industrial supplies; the nature of the demand for water by different industries; and the actual demands for water for domestic consumption by families of different means.

Evening—

"Damage to Deep Wells by Sea Water," by Dr. William P. Mason.

"Cost-Plus Contracts in Water Works Construction," by George W. Fuller.

"Standard Forms for Contracts," by G. W. Buchholz.

"The Trend of Prices," by Leonard Metcalf.

Arrangements are under consideration for trips about the city of Montreal, to the water works plants and other places of interest. Arrangements are also being considered for a trip by special boat leaving Montreal Friday evening for the Saguenay River.

The above program will be revised and added to, making a convention that no member should miss if it is at all possible to attend. It is estimated that the attendance will be considerably more than one thousand.

Fair Wage Schedule of the Manitoba Department of Public Works

PUBLIC notice has been given that under the provisions of Section 10 of Chapter 121 of the Statutes of Manitoba, 1916, (being the Fair Wage Act, 1916), the Manitoba Minister of Public Works has approved of the rate per hour and the working hours, set forth in the following schedule, as the minimum rate per hour payable to any employee engaged in the respective trades, and the maximum number of hours during which any employee engaged in the respective trades shall be required to work; and that the said schedule shall apply and be effective for employees engaged on public works on or at the Building, and that the said schedule shall be effective from May 1, 1920, until April 30th, 1921, or until such time as another order may be made by the Minister of Public Works.

Fair Wage Schedule, Winnipeg, Manitoba

The following schedule shall apply to the City of Winnipeg and a radius thirty miles therefrom, from May 1, 1920, to April 30:

	Rate per Hour.	Hours per Week.
1. Laborers, engaged on building construction	.60	50
2. Teamsters	.60	60
3. Bricklayers	$1.25	44
4. Stonemasons	1.25	44
5. Marble setters	1.20	44
6. Mosaic and tile setters	1.00	44
7. Terrazzo workers:		
(a) Layers	.85	44

No. 24

Canada's Engineers—Blair Ripley

During the war few of Canada's engineers did work of more real moment than Mr. Blair Ripley, who, as commander of the first Canadian railway construction battalion to go to France, was responsible for solving many of the transportation problems upon which the success of the troops in the field depended. Mr. Ripley's long railroad experience proved of immense assistance to all the allied forces and he was personally congratulated for his services by the commander-in-chief as well as some of the army commanders and the director general of transportation. For his war time work he was honored by triple mention in dispatches, and the award of the Distinguished Service Order and was made a C. B. E.

Although born in Nova Scotia, in 1880, Mr. Ripley's early engineering experience was gained in the West. In 1898, he began with the Canadian Northwest Irrigation Company, in Alberta. From 1901 to 1903 he was assistant engineer of the Great Falls & Canada Railway Company, the Alberta Railway & Coal Company and the St. Mary's River Railway Company. He became engineer of construction of the last named company, but relinquished this position in order to accept a similar one with the Alberta Railway & Irrigation Company. Mr. Ripley then became connected with the Grand Trunk Pacific as resident engineer in Manitoba and Saskatchewan and assistant engineer on harbor work at Prince Rupert, B. C. In 1907 he became resident engineer for the C. P. R. on grade revision between Maple Creek and Medicine Hat and then engineer in charge of field work on the Lethbridge viaduct. On completion of this project he was appointed engineer in charge of the Old Man's River viaduct at McLeod and then in charge of the viaduct at Outlook, Sask. Upon the purchase in 1910 by the C. P. R. of the Dominion Atlantic Railway, one of the oldest in Canada, he reported on possible improvements and prepared for the replacing of many difficult bridges in the tidal waters of the Bay of Fundy. In June, 1912, he came to Toronto for the C. P. R. in charge of North Toronto grade separation and terminal construction. When this work was completed he was, on the recommendation of the C. P. R., commissioned lieutenant-colonel of the first Canadian Railway Construction battalion, which was continuously in service in France from October 1916. Col. Ripley returned to Canada in April, 1919, rejoining the C. P. R. shortly after, being recently appointed engineer of the Ontario district. He is a member of the Engineering Institute of Canada, the Institute of Civil Engineers of Great Britain and the American Society of Civil Engineers.

Mr. Blair Ripley

(b) Helpers	.65	50
8. Stone cutters:		
(a) Carvers	1.12½	44
(b) Journeymen	1.00	44
(c) Planermen and lathemen	.90	44
9. Plasterers	1.12½	44
10. Wood, wire and metal lathers	1.00	44
11. Plumbers	1.00	44
12. Steamfitters	1.00	44
13. Operating engineers on construction:		
(a) Engineers in charge of machines with three or more drums	1.25	50
(b) Engineers in charge of double drum machines	1.12½	50
(c) Engineers in charge of single drum machines	1.00	50
(d) Firemen	.75	50
14. Sheet metal workers	.90	44
15. Painters, decorators, paperhangers and glaziers	.87½	44
16. Blacksmiths	.85	44
17. Electrical workers (Journeymen inside wiremen)	.92½	44
18. Bridge and structural steel and iron workers	1.25	44
19. Asbestos Workers:		
(a) Journeymen	.90	44
(b) First-class improvers	.80	44
(c) Second-class improvers	.70	44
20. Asphalters:		
(a) Finishers	.75	44
(b) Men engaged preparing, mixing and heating materials	.60	50
21. Carpenters	1.00	44

The schedule applying to any portion of the Province of Manitoba other than the city of Winnipeg, and a radius of 30 miles therefrom, differs from the above only in the wage payable to laborers and teamsters, which is 55 cents instead of 60 cents.

Announcement has been made of the reorganization of the Rust Engineering Co., of Pittsburgh, which is represented in Canada by F. H. McKechnie, of Montreal. The partnership formerly existing between S. M. Rust, of Pittsburgh, E. J. L. Rust, of Birmingham, and E. M. Rust, of Washington, has been dissolved and three separate firms have been incorporated, viz., the Rust Engineering Co. of Pittsburgh, the Rust Engineering Co. of Birmingham, and the Rust Engineering Co. of Washington. The three former partners will form the majority of the directorate of each of the three companies.

Plans have been completed for the new theatre at Regina, Sask., for the Trans-Canada Theatres, Limited. It will be erected on the site of the Auditorium rink, at the corner of Rose & Twelfth Avenues. The building will contain eight stores on the ground floor, offices on the second floor, and smoking room, rest rooms and dressing rooms. It is estimated to cost $335,000 when completed.

Mr. A. B. Connell, K. C., Woodstock, was appointed chairman of the Public Utilities Commission of New Brunswick, recently. Mr. Connell has been a member of the commission since 1912.
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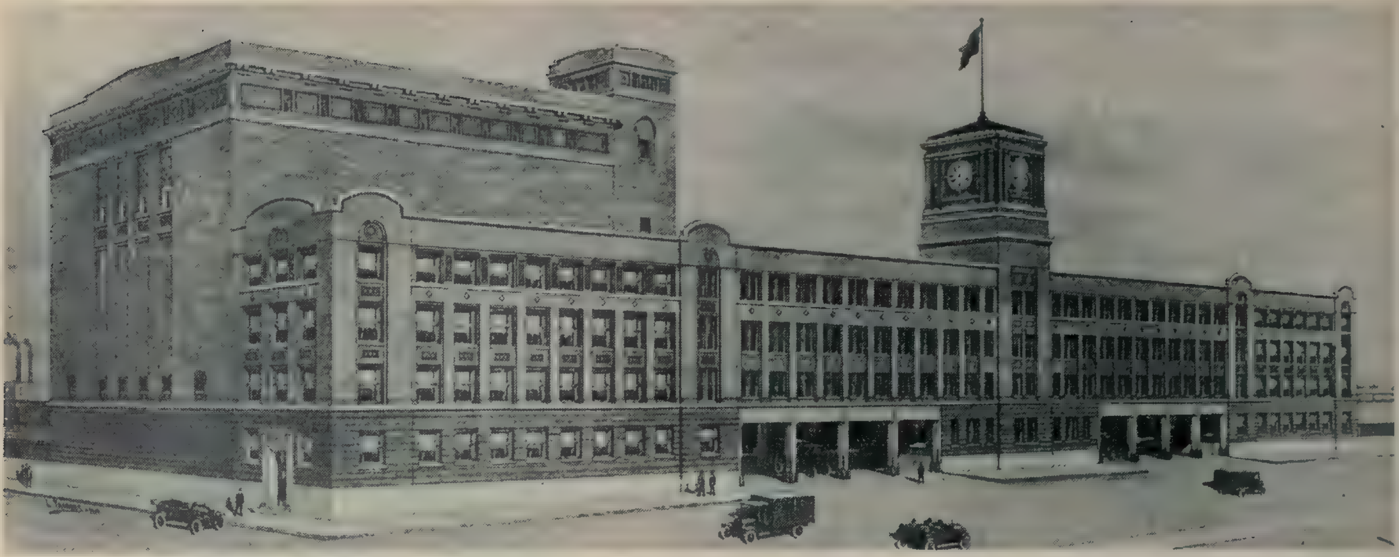

Fig. 1—This illustration shows the recently constructed cooler building, warehouse and office for Gunns Ltd. at West Toronto, Ont. The tower and building at its right have not yet been constructed

Cooler, Warehouse and Office Buildings for Gunns Limited at West Toronto, Ont.

The Last Word in Packing House Construction—Cooler Building has Double Framing to Provide for Cork Insulation

By J. B. Carswell, B.Sc., A.M.E.I.C., A.M.Inst.C.E.*

IN the month of March, 1919, the progressive firm of Gunns Limited, packers, West Toronto, Ont., decided to proceed with a comprehensive scheme of enlargement to their business premises in order to take care of their rapidly expanding business. Messrs. Henschien & McLaren, architects, engineers, and specialists in packing house construction, were retained to make a complete survey of the existing plant, in order that the new buildings contemplated would work in as units of the final scheme.

The need for additional floor space was so urgent that the actual construction was started a few days later. The Carswell Construction Company were selected as general contractors to carry out the work, and the first drawings received were made by the architects on the back of an envelope. It may be said to the credit of Henschien & McLaren, that not once during the construction was the work held up for lack of information.

The scheme which was finally decided upon comprised the construction of three distinct buildings: a cooler building, five storeys high, with provision for a further three storeys on top, having a floor area of 71,000 square feet; a warehouse building, four storeys high, with floor space of 24,000 square feet; and a modern office building, four storeys high, with an area of 19,000 square feet.

Cork Insulated Walls and Floors

The cooler building was designed to have reinforced concrete floors of the flat slab type, using the Corrugated Bar Company's two-way system. Circular columns were used in the basement, 38 inches in diameter, reducing to 27 inches diameter on the top floor. The feature of this framing was the split columns necessitated by the cork insulation. The main exterior walls are supported on an entirely independent reinforced concrete frame work, 6 inches of cork insulation being placed between it and the interior frame work taking the floor load. Fig. 2 shows this clearly. Practically 400,000 square feet of corkboard was used in this building, making it in reality one large refrigerator.

The floor slabs vary in thickness from 8 inches to 11½ inches, and the live load from 125 to 250 pounds per square foot. The columns are spaced 20 feet centre to centre, both ways. The Port Credit Brick Company's wire-cut brick was used on the exterior and 12-inch Natco hollow tile was used for backing. Fig. 1 shows the elevation of this building with the office building in the foreground and the warehouse building to the right.

In the basement of this building are provided large pickle vats with heavy reinforced concrete walls. The basement floor itself, which is used as a meat cellar and is subject to the action of the brine from the pickle vats, together with very heavy trucking, is paved with the Streator Brick Company's paving brick, which has been found eminently suitable for this class of work, the brick being burned almost to complete vitrification.

Low Temperatures in Cooler Building

The first floor of the cooling building is particularly well lighted and painted with "Stay-White" enamel. The temperature of this floor is maintained just a little above freezing. The second and third floors of this building have a slightly lower ceiling, and are used as freezer storage and as beef freezer, respectively. The temperature of these two floors is maintained in the neighborhood of zero and consequently, cork insulation had to be introduced beneath the floor slab at the second floor level and at the ceiling line on the third floor level. This cork insulation was placed directly on the forms, steel reinforcing placed on top and the concrete floor laid in the usual way. The fourth floor is connected by an overhead bridge to the killing rooms in the main building and the warm carcasses are brought over by means of a conveyor and taken directly into the meat-chilling room. Mezzanine, or spray loft decks are provided on this floor. These are, of course, heavily reinforced concrete slabs, cantilevered out from the columns and are thoroughly waterproofed and graded to down-pipes. Fig. 2, the main cross section of the building, shows the above points clearly.

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*President, Carswell Construction Company, Toronto.

Refrigeration Methods

For the refrigeration of the cooler it was necessary to consider that two-thirds of the building would be carried at a temperature of from 32° to 36° Fahr. and the balance at a temperature of 15° Fahr. down to minus 10° Fahr. For the higher temperature work it was decided to use the brine system of refrigeration. A large storage tank for cold brine was built of concrete and insulated with cork-board. The brine is refrigerated by means of 1¼ in. pipe coils, through which sufficient ammonia is expanded to cool the brine to a temperature of 17° to 14° Fahr.

The chilled brine is pumped to the cold storage rooms and employed according to the requirements of the operating conditions of these rooms. Where the warm beef is hung on the fourth floor, a system of brine sprays are installed whereby the brine is sprayed over the mezzanine floors already described. The animal heat from the meat rises through the air ducts up to the mezzanine floors where it is exposed to a continuous spray of brine. This cools and purifies the air and condenses the moisture. The temperature of the brine increases four to five degrees by coming in contact with this warm air and it is, therefore, returned by gravity directly to the brine tank for recooling.

In the sales cooler on the first floor, where the refrigerated beef is stored after the first chilling, a different system of brine refrigeration is employed. This room requires refrigeration to maintain a temperature of 34° to 36° Fahr., and the air should be frequently circulated and purified. A system of eight-inch galvanized pipes, open at each end, was installed, and the cold brine is sprayed through these pipes. This creates a suction which circulates the air through the pipes and brings it in contact with the cold brine, so that it is refrigerated and purified. By this method a constant circulation of pure air is set up in the cooler, which is very important where meat is kept for some time.

The curing rooms in the cellar are refrigerated by direct expansion of ammonia, which is pumped through a system of cooling pipes in sufficient amount to maintain a temperature of 36° to 38° Fahr.

Ten Degrees Below Zero Maintained in Places

The same method of refrigeration was employed on the second and third floors in the low temperature rooms used for freezing meats and storage of frozen products. Two-inch ammonia pipes were installed on the ceilings; through these ammonia is expanded as may be required to maintain the desired temperature. Some of these rooms can be made as cool as 10° below zero. This temperature is necessary where meat products are to be frozen quickly. As soon as the meat is thoroughly frozen it is removed from the sharp freezer into the storage freezer and held at a temperature of 10° to 15° Fahr, hence the necessity of the floor and ceiling insulation, as mentioned above.

The entire refrigeration was designed by Henschien and McLaren and installed by the engineering department of Gunns Limited, under the supervision of their chief engineer, Mr. Gibson. The refrigerat-

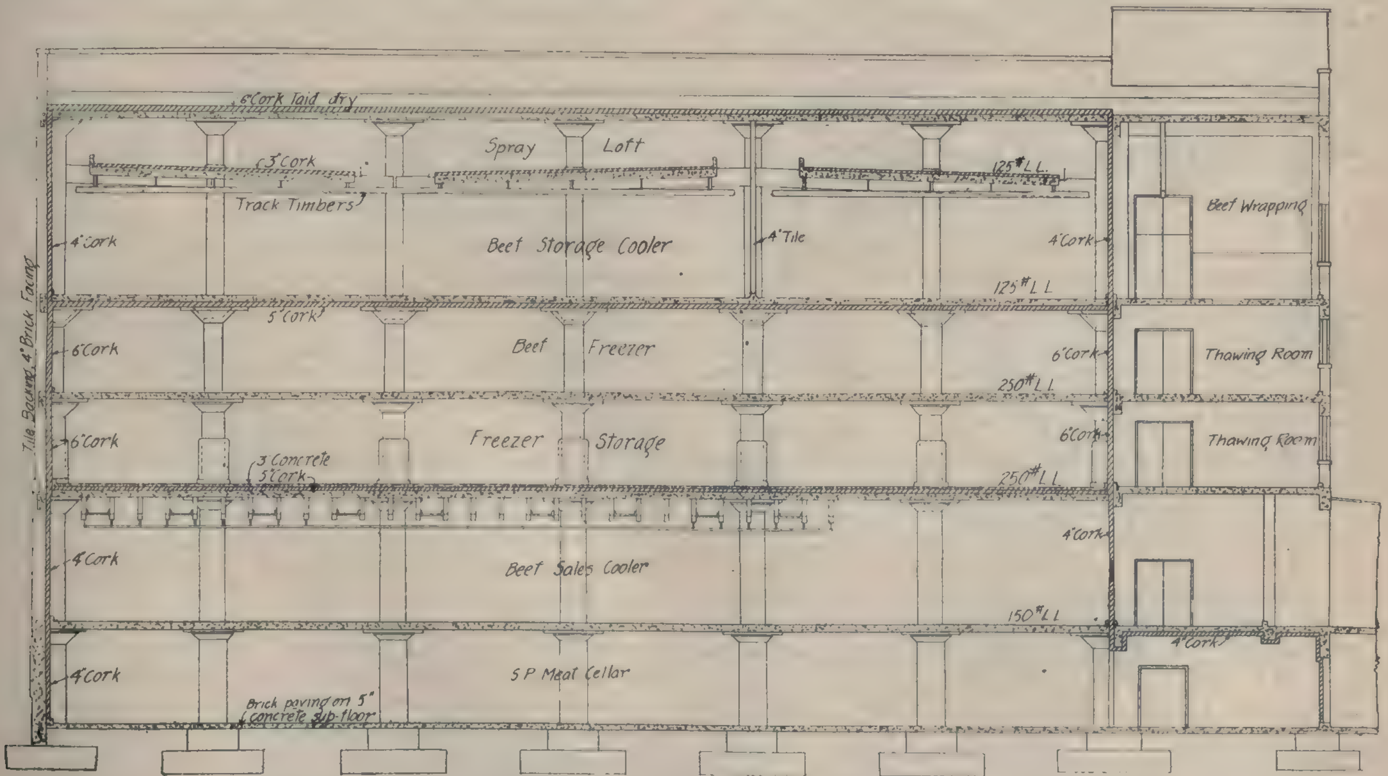

Fig. 2—The main cross section of the cooler building, illustrating special nature of the design

ing machinery was purchased from The Canadian Linde Company, Montreal.

Another big feature of these buildings is the construction of the doors. Intercommunicating doors within the cooler building itself are constructed with maple rails and filled in with matched white pine placed vertically. The whole door is bound together with 3/8 inch bolts with counter-sunk heads fastening through the breadth of the door. The openings leading out of the cooler building are equipped with heavy refrigerator doors of standard pattern on the inside and steel plate doors on the outside. Most of these doors are built in four leaves, Dutch type, in order to take care of the meat rails passing through the openings. Certain other openings are equipped with combined cooler and fire doors of an interesting detail.

The whole building is equipped with an extensive system of meat rails. These are hung from the flat slabs on 6-inch by 8-inch yellow pine beams by means of inserts placed on the forms before pouring. The meat thus passes through the various processes from the killing room into the hanging cooler, down through the different floors and into the elevator without once being handled. A "beef drop" is provided in one corner by means of which the meat is passed from one floor to another by gravity.

Office and Warehouse Buildings

The framing used in the office building is also reinforced concrete with combined hollow tile and concrete floors. Three floors are devoted to executive offices and the fourth floor to staff recreation and dining rooms.

The warehouse building is of a simple reinforced concrete beam and girder construction.

Construction Methods

Construction was commenced about the middle of March, 1919. The general excavation of 8,000 cubic yards was done by steam shovel, and that for the pickle vats, which were located under the office building and considerably deeper, by a travelling stiff-leg with clam shell bucket.

To handle the 7,000 cubic yards of concrete, a stiff-leg derrick with a yard and a half clam was erected in position to reach material cars on both tracks and discharge directly into overhead stone and sand bins above the mixer. The mixed concrete was hoisted in a tower, and distributed by a combination of hoppers, chutes and buggies, and on the floors the average pouring was a cubic yard every minute and three quarters. Almost every foot of the floor in the cooler and warehouse buildings had a one-inch finish laid integrally with the base, and hardened with about six pounds of "Ferro-fax," to a bag of cement.

The column and drop head forms were of 2 in. stock, and the slab form of 7/8 square edged. The design of form work was necessarily intricate, because of sloping floors, varying floor thicknesses, and storey heights, and because of the four and six-inch space between the twin columns and beams.

All cork insulation was in two thicknesses with broken joints. For ceilings and floors, the two layers were laid upon the forms, with mortar bed between and the concrete placed on top. On vertical surfaces the bond between the first layer of cork and the concrete was made by mortar. The second layer of cork was dipped in mineral odorless asphalt, which formed the bond. Where cork was laid on floors, both layers were laid up in mortar. All cork surfaces were finished with a scratch and finish coat of cement plaster, and given a glazed surface.

All elevations, as seen from the streets, show full brickwork and are very attractive in appearance, with colored brick panels and glazed tile ornaments. Sills and coping are in Indiana limestone.

The owners were utilizing portions of the buildings from August onward. At the same time, extensive improvements were made to the old buildings, and towards the completion of the work three more storeys were added to the north end of the cooler building, to take care of pickle-making equipment. The entire new plant was in operation in December.

An Imposing New Church in St. John, N. B.

St. David's Church, Replacing Burnt Edifice, is Designed on Gothic Lines—Details of the Design and Architecture

THE new St. David's Church in St. John, N. B., occupies the site of two former church buildings which were successively destroyed by fire. In many ways the new edifice is superior to both of its predecessors. The imposing facade is of rock-faced, Spoon Island granite with tooled freestone trimmings. The style is perpendicular gothic.

A narthex, 12 ft. 6 in. wide and 30 ft. long, entered by three massive doors, gives access to the main auditorium. This entrance, floored with 9 in. red quarry tile, with walls rough-plastered and panelled in brown ash and vaulted ceiling, is shut off at either end by a handsome brown ash and leaded glass screen from the stair halls, 12 ft. 6 in. by 20 ft. From the latter, stairs lead, by easy stages to a gallery running the full width of the front and having a seating capacity of 190.

The main auditorium is 57 ft. wide, and 80 ft. deep, with a transept on either side 27 ft. wide and 11 ft. deep. The woodwork of rafters, trusses, pulpit, pews, panelling, etc., is of dark brown ash, the effect of which is greatly enhanced by some exceptionally fine carving, the work of a veteran master of the craft, Mr. John Rogerson, who, though now in his 83rd year, carved the capitals of the clustered columns at either side of the choir arch and transept arches, brackets at the base of the roof trusses, and the beautiful panels of the pulpit as his contribution to the church of which he has been a faithful attendant and office bearer for some 70 years.

Opening off the auditorium are the choir room, 17 ft. x 26 ft. and the vesty 15 ft. x 17 ft. In the rear is the Sunday school building now partially completed and which makes provision for a main room, 35 ft. x 48 ft., which, by means of rolling partitions, can be enlarged to two parlours, one 16 ft. x 32 ft. and the other, 18 ft. x 32 ft. Along one side of the main room are four class rooms, each 9 ft. x 11 ft., and library. There is

Exterior and interior views of St. David's Church at St. John, N.B., one of that city's imposing religious edifices.

also a gallery containing four class rooms, primary class room and pastor's room. The lower floor contains gymnasium with 14 ft. ceiling, large meeting room, kitchen, pantries, storage rooms, and boys' and girls' lavatories.

Lighting is done by the indirect system and is found to be very satisfactory. The building is heated by steam supplied by two boilers cross connected so that one or both can be used as desired.

Ventilation is secured by the use of indirect coils which deliver a supply of fresh, warmed air through registers in the floor.

The fine organ was installed by Cassavant Freres of St. Hyacinthe, Que.

The architect of the building is Mr. F. Neil Brodie of St. John, N. B. The work of construction was done by the following: General contractor, J. Medley Belyea; mason work, B. Mooney & Sons; heating and plumbing, J. H. Doody; electric wiring and fixtures, Vaughan Electric Co.; painting and glazing, J. H. Pullen; seating, Valley Seating Co., Dundas, Ont.

The cost of the building, including the organ, was about $120,000.

Dr. Ellis Honored by E. I. C.

Presented with Badge of Honorary Membership by Toronto Branch—Prof. Slater Lectured on E. F. C. Tests

DR. W. H. Ellis, formerly Dean of the Faculty of Engineering and Applied Science at the University of Toronto, was presented with the gold badge of honorary membership in the Engineering Institute of Canada at the final meeting for the season of the Toronto branch, held on May 13th. The presentation was made by members of the branch at the request of the Council of the Engineering Institute in tribute to Dr. Ellis' long and distinguished service in the field of engineering and applied science.

The public had not realized the varied qualities possessed by Dr. Ellis, declared Prof. H. E. T. Haultain in a brief speech of introduction. They were of an academic, scientific and business nature, and he was eminent in all three. He was a poet of no mean ability, a skilled raconteur and a fisherman. He was the outstanding man of culture in the university—many-sided, well-rounded. Many men had come under his beneficent influence in the character of a teacher. But he was not of a soft, gentle, academic type. He had borne arms in his country's service. Lately during the clash resulting from the rivalries of the Dominion and Provincial Governments on the subject of the training of returned men, in which work Dr. Ellis had taken a responsible post, he had stood firm and the storm had passed. Through his influence the School of Engineering Research had been established and in this respect he was specially worthy of welcome by the Engineering Institute.

Mr. C. H. Rust, a former chairman of the branch, spoke of the admiration and love of his students for Dr. Ellis. Mr. R. O. Wynne-Roberts, chairman of the branch, then presented the gold badge to Dr. Ellis, amid hearty applause.

In replying, Dr. Ellis stated that, while he was not an engineer, he had long worked and associated with engineers, and had, perhaps, gained some of their atmosphere. He appreciated the honor greatly.

Concrete Ship Not a Failure

"There is a general impression that the concrete ship has failed," remarked Prof. W. A. Slater, B.S., C.E., M. S., Engineer Physicist, United States Bureau of Standards, in the course of a lecture, following the presentation, on the testing of reinforced concrete beams and ship frames for the United States Emergency Fleet Corporation. "I want to correct that impression. I am not ready to say that it has been an unqualified success, but structurally, so far as we know anything about it in use, it has been a success."

A concrete ship would suffer the same damage as other types of ship in collision, said Prof. Slater. The salvation of the ship was the ease of repair and the smallness of the hole resulting from impacts. Extensive tests had been carried out to prove the strength of reinforced concrete for ship purposes. The failure of the concrete in these tests had been a tension failure. They showed that it was necessary to inspect the steel used as carefully as the concrete. Prof. Slater showed a number of photo and diagram slides illustrating the results of tests.

The contracting business, formerly conducted by Mr. J. C. Diffin of Welland, Ont., has now been taken over by the Diffin Construction and Supply Company, Limited.

With a capital of $20,000, the Joliette Sand Pit Company, Montreal, has been incorporated to deal in sand of all kinds and to open and work sand pits.

Investigations on the Presence of Alumina Hydrate in Mechanically Filtered Water

Its Occurrance was Noted in All Waters Examined—Presence in Toronto Water is Devoid of Any Sanitary Significance

By Norman J. Howard and Frank Hannan*

THE question of the presence of aluminum hydrate in the effluents of mechanical filtration plants has recently caused considerable differences of opinion amongst those directly concerned in the purification of public water supplies. In Toronto, where the new drifting sand is in commission, an alumina reaction has always been obtained in the filtered water, and in view of the fact that this is an entirely new system, it has been claimed by some to be caused by the direct application of aluminum sulphate to the filters, without a preliminary period of coagulation and sedimentation. The exponents of the standard mechanical gravity filter claim that the filtered water from mechanical plants, if properly operated, would yield an effluent entirely free from aluminum sulphate or aluminum hydrate.

Presence of Aluminum Hydrate is Common

Correspondence has passed between numerous engineers, sanitarians and the writers, as to the conditions existing principally in the states of New York, Maryland, Rhode Island and province of Ontario. The consensus of opinion was that the presence of aluminum hydrate in the effluents of many mechanical plants was not an unusual condition and was frequently met with, and the reason why such cases had not appeared in the experiences of some waterworks authorities might well be due to the fact that a number of consulting engineers have little or no routine relation with the daily operating details or results in filtration plants.

In view of the importance of the question it was thought desirable to investigate further the conditions with the object of throwing light, if possible, on a subject involving a study of some of the colloidal properties of aluminum about which so little is known. It is yet too early to form any definite conclusion and the opinions expressed hereafter are only based upon conditions as actually found to exist in Toronto.

Investigation in the laboratories of the filtration plant have confirmed previously expressed opinions that the removal of aluminum hydrate in treated Lake Ontario water was an impossibility. It is not proposed to even consider the question of aluminum sulphate occurring in the effluents of the Toronto plant, as with a normal alkalinity in the raw water of nearly 100 parts per million estimated as calcium carbonate, the presence of undecomposed alum would be a chemical impossibility.

The initial laboratory experiments were made with mechanically filtered water, and with water treated in the laboratory with aluminum sulphate. The quantity of chemical applied ranged between one-half and two and one-half grains per Imperial gallon. A period of four hours sedimentation was allowed the laboratory samples before filtering through small rapid sand filters. The samples were then tested for a positive or negative alumina reaction. The reagents used were fresh solutions of extracts of logwood (1 per cent.), haematoxylin (0.3 per cent.) and N x 6 acetic acid. The presence of alumina was determined by the formation of a blue to purple color which, after acidification, turned to pink or brown. In the absence of alumina a deep pink color resulted which turned to yellow on addition of the acid. It was found that control tubes were always necessary on account of the extremely sensitive nature of some of the reactions.

Hydrate Present In Every Case

Throughout the whole series of a large number of tests, not a single sample that had been mechanically filtered or artificially treated with alum in the laboratory failed to give a positive reaction. Further experiments were made to determine if six thicknesses of very fine paper would retain the hydrate. The filter papers used were Whatmans number 5. In order to get water through the filter a suction pump was used. The results of these tests were extremely interesting as it was found that the first 50 c.c. of water which had passed through showed a considerable decrease in the intensity of reaction. The next 50 c.c. gave an increase over the first 50, while after the passage of 200 c.c., little change could be seen in the filtered and unfiltered solutions. This clearly pointed to adsorption and the explanation of this would seem to point to the action being electrostatic. When positive hydrosols are passed through filter papers which are negatively charged in contact with pure water, adsorption of the positively charged hydrosols (colloidal alumina) and the neutralization of the negative charge of the filter paper results. When sufficient of the hydrosols have passed through to render the filter paper neutral, adsorption no longer takes place and alumina passes through freely in colloidal form. This explanation is supported by the fact that a filter paper which has had its negative charge neutralized by the adsorption of Al ions has much less action than a fresh paper.

A similar experiment was made with the positive colloid methylene blue (.5 p.p.m. or a .00005 per cent. solution). This was passed through six thicknesses of filter paper and the color was retained until 1115 c.c. had passed, after which a gradual and progressive increase was noted. The experiment was continued until 10,065 c.c. (approximately ten litres) had been filtered, after which it was impossible to distinguish between the filtered and unfiltered solutions.

Variation in Rate of Filtration Has Little Effect

Experiments were next made to determine the effect of variation in the rate of filtration. Water treated with 1 grain per gallon and mechanically filtered at the rate of 75,100.125 and 150 million gallons per acre per day showed little change in the alumina reaction. It should be pointed out here that our observations showed the sand to retain alum for a considerable period after the application of alum had ceased, and that frequent backwashing was necessary to free the sand particles from the hydrate. This experiment was duplicated using the small laboratory filters when similar results were obtained.

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*Bacteriologist in charge and chemist, respectively, Toronto filtration plant laboratories.

Further tests were made to determine the effect of the addition of $Ca(OH)_2$ to water treated with aluminum sulphate. To each sample of raw water one grain of alum was added plus the molecular equivalent of lime water (1.5 c.c. of N x .04524 $Ca(OH)_2$ solution) necessary for exact precipitation. The application was in the following order:

Series. 1. Water + Lime + Alum
2. Water + Alum + Lime
3. (Alum + Lime) + Water
4. Water + Alum
5. Control Water + Lime

The physical effects were first observed and it was seen that numbers 1, 2 and 4 generally flocced in a similar manner, but that number three produced a heavier flock which precipitated rapidly. The principal reason for making these tests was to determine if the addition of lime would decrease the residual hydrate after filtration. After standing thirty minutes all samples were filtered through fine filter papers (Whatmans No. 5) and then tested for the alumina reaction. The whole series excluding the control gave a positive reaction. A slightly weaker reaction was obtained from number three, while the control consisting of water and lime alone gave a negative reaction.

No Water Failed to Show Alumina

Considerable other work has been carried out and every endeavor made to find a water in Ontario that had been treated with alum in the laboratory or mechanically filtered after the application of aluminum sulphate, which would not give a positive alumina reaction. Samples under observation included:—

1. Drifting-sand filtered water.
2. Mechanical gravity filtered water.
3. Mechanical pressure filtered water.
4. Well water treated with $Al(SO)_3$.

Very careful technique and negative controls, having a similar degree of alkalinity were found to be always necessary in order that strictly accurate reactions could be recorded. On account of the large number of examinations involved and the absence of any known rapid method for estimating minute traces of alumina, it was not found practicable to make quantitative estimations. So far, we have been unable to find a water which after treatment has not yielded a positive alumina reaction. We believe that the principal points involved are the hydrogen ion concentration of the water under treatment, and the colloidal nature of the alumina when in solution. It seems to us very doubtful that the complete removal of decomposed alum in water having a similar hydrogen ion concentration (Ph 8-8.6) can be achieved by filtration. Laboratory experiments have shown alumina to remain in solution after standing for a period of four months, but it was noticed that the hydrate underwent a change and probably became an aluminate. In what form we are at present unble to say. Of recent date chemists would appear to be satisfied with distinguishing only two sets of colloidal solutions, which they have called solutions of alumina and metalumina.

So far as we are in a position to judge, the residual hydrate in the Toronto water is harmless, has no corrosive properties, and is devoid of all sanitary significance. Mr. Rudolph Thompson of the laboratory staff has taken an active part along with the writers, in the whole of the experimental work carried out.

Summary of Observations and Probable Fate of Hydrosols in Mechanically Filtered Water

1. Effluents from all treated waters examined gave positive reactions.

2. Intensity of reaction slowly diminished on long standing, but after four months was still perceptible.

3. If 25 c.c. of concentrated salt solution (commercial $NaCl$ were added to one litre of treated water, no reaction could be observed after sixty days.

4. Freezing did not affect the reaction neither did boiling.

5. Concentration by boiling to one-tenth of original bulk threw down a rather abundant crystalline precipitate which included considerable Al. The clear solution no longer gave the reaction.

6. Filtered through six thicknesses of Whatman number 5 filter paper the reaction was still obtained. There was evidence of adsorption of sol by the paper.

7. The sols freely ascended bibulous paper: over 13 cm. in 48 hours.

8. Water of Ph 8.0-8.6 yielding no reaction if brought into contact with alumina gels, or if passed through a filter paper which has adsorbed alumina sols will yield a positive reaction.

9. Non reacting Al in solution can be brought to react by slightly acidifying, boiling, cooling and restoring the original Ph value by cautious addition of ammonium carbonate. The presence of iron may interfere with this test, as haematoxylin combines with iron in preference to alumina when both are present together in reactive form.

These reactions can be accounted for if we assume:—

1. Haematoxylin enters into reaction with alumina sols but not with alumina ion.

2. Alumina gel is readily peptised in presence of OH-ion, even at Ph8.

3. Alumina sols are not stable in presence of OH ion but are converted into aluminate ions

$$Al(OH)_3 + OH^- \rightleftarrows AlO_2^- + 2H_2O.$$

4. Aluminate ions are stable in presence of OH ion but are decomposed by acids with formation of aluminum ions

$$AlO_2^- + 2H^+ \rightleftarrows Al(OH)_2^+.$$

5. The degree of dispersion of the sols is probably greater
   (A) In presence of $NaCl$
   (B) With increased OH-ion concentration
   (C) After severe filtration

6. Higher dispersion accelerates the course of reactions.

These assumptions should not be regarded as anything more than a first approximation. The reactions which actually take place are in all probability far more complex.

The Rancourt Construction Co. Ltd., recently incorporated, has opened offices at 715 Power Building, 83 Craig St. W., Montreal. Mr. J. C. Rancourt, manager of the firm, wishes to get in touch with several estimaters and architectural draftsmen and would also be pleased to receive catalogs on building material and equipment.

Farm Housing Demands More Consideration

Problem Requires Immediate and Adequate Attention—Suggested Features of Construction

THE question of farm housing is one of the utmost gravity. It is intimately and fundamentally connected with a basic industry, agriculture. It has been left, in the main, to develop almost automatically, without help or guidance from any source that might be qualified to render material aid or able and intelligent suggestion. It is to-day a problem that demands immediate and adequate attention if the best interests of our nation are to be conserved.

Recent investigation by federal and state authorities indicate that the spirit of unrest and dissatisfaction so prevalent in other industries, extends also into the agricultural field. It involves directly or indirectly, the farm owner, the farm tenant, and every farm worker. Though there has undoubtedly been improvement in general living conditions on farms, making the comparison from generation to generation, still the change has not been commensurate with that in favorable urban communities. This insufficient development, in connection with other universally disturbing factors, such as unsettled labor and discouraging market conditions, is productive of a spirit of discontent and depression which is becoming increasingly apparent, and which will undoubtedly result in increasingly unfavorable reactions.

The fact that housing conditions on many of the farms of the country are notoriously inadequate and are instrumental in promoting dissatisfaction among our agricultural population is brought out in a committee report read at the National Conference on Concrete House Construction. All industries, continues this report, are looking to agriculture to exert that ameliorating influence which might act as oil on troubled waters. No effort should be spared which in any way will contribute to the strength of this influence; agricultural contentment is essential to universal, industrial peace; good home life is the basis of agricultural contentment, and a good home is essential for the enjoyment of good home life.

"In the near future many new farm houses will be built; they should be built so as to include the maximum of desired features. Health and happiness in the home are not marketable commodities, and yet if estimated through a term of years, no one could deny that tangible profits would accrue from an investment in a home which would insure more comfortable living conditions and healthier population. In accordance with human tendencies, the mistakes and triumphs incorporated in the structures of one generation will be transmitted to the next where their influence will be unfavorable, or favorable, as the case may be. The present generation should feel it their duty to build wisely for the future."

Purposes of the Farm House

The fundamental purposes of the farm house, that of providing shelter and warmth naturally apply to the farm house as well as to a house in any location. Because rural conditions, however, are different from urban or suburban conditions, it may be well to further differentiate the reasons why farm houses are necessary. The report referred to names these reasons as follows:—

1. To provide shelter from the elements and their effects, such as rain, snow, ice, wind, heat, and cold.
2. To furnish protection from animals, vermin, and insects.
3. To provide safe and adequate storage for the various goods and treasures of the family.
4. To provide an administrative centre from which the farm operations may be directed.
5. To provide a place in which the social life of the family may be developed and consummated.
6. To make provision for the desirable privacy of the individual and the family.
7. To provide a home.

Economic Minimum for the Farm House

Perhaps the fundamental issues of farm housing can be most readily examined if there be made first a definition as to what should constitute an economic minimum of requirements for the dwelling. It is recognized that promulgation of such a minimum can be made only after a most serious consideration of all the conditions and influences affecting farm life, and that no one minimum can be made which will be universally applicable to all conditions, in all localities. Authorities may also differ as to what constitutes a minimum, and it can be readily conceived that items of such a minimum may change from time to time. This minimum standard should be based on the least household provision at which wholesome living conditions can be maintained from the standpoint of health, labor, care, maintenance, and enjoyment. There are at least three viewpoints which should be considered as of major importance in the preparation of the minimum standard. These are: 1. Construction; 2. arrangement; 3. equipment.

The period of early settlement when there was pressure to provide shelter for people under any kind of roof, has passed and we have progressed through several stages of recent housing development until the time is now reached when all manner of building is expensive. It is necessary to examine carefully every point connected with building in order that there be no admission of extravagance at any point. It can be reasonably asserted in the opinions of prominent authorities that the establishment of a housing standard at the present time may be made with fair assurance that it may endure for a comparatively long period of time. Consequently, future needs and possibilities should be given consideration as well as present conditions.

The arrangement of a house is based primarily on its needs. "Broadly speaking, family life makes three demands on a house plan; that it shall provide living area, working area, and sleeping area. It is the function of a good plan to organize these three into a compact arrangement, allowing each requirement an area to itself. Spaciousness must be expressed in the living area, compactness in the working area, and privacy in the sleeping area." The whole arrangement must be made so as to encourage wholesome living.

Conservation of time and energy is obviously one of the problems, the solution of which is necessary for the successful conduct of the household operations. Perhaps the most important way of achieving such conservation is to make use of proper and adequate labor saving equipment. Carefully chosen, the items of equipment will yield return in comfort, economy, and sanitation. It will be true economy to include any item which will enable the physical business of living to be accomplished with fitness and despatch. The more perfectly the home is equipped, the greater opportunity will the spirit have to grow and to express itself.

A List of Minimum Requirements For a Good Farm Residence

1. The material entering into the construction of the building should be reasonably permanent in order that the depreciation and the cost of maintenance be kept as low as possible and that the structure be reasonably safe from destruction by natural causes.
2. Water tight construction in walls and roof.
3. Adequate insulation from cold in order that a reasonable degree of warmth may be maintained within the building.
4. Smooth, tight floors.
5. Light, dry basement in which should be made provision only for storage or for the location of household equipment.
6. Adequate space set off for sleeping purposes, separate bedrooms being provided for the use of parents, or male children, and of female children.
7. Every bedroom to have an adequate clothes opening from the room.
8. Provision made for culinary operations and for dining purposes.
9. A room in which the family may assemble, and in which social life may be developed. The dining accommodations may be included in this room if desired.
10. Adequate equipment to lessen labor and to simplify the conduct of household operations; this should include heating, lighting and water supply.
11. Adequate sanitation, including lavatory, bath tub and water closet, with proper connection to sewer or septic tank. These fixtures should be included in a separate room.
12. Adequate provision for light and ventilation, with at least one window that may be opened in every room.
13. The house should be made consistently beautiful and attractive.

The various items included in the list immediately preceding may be considered as fundamental requirements which must be included in every farm house of whatever kind or description. Naturally, there are many other features which can be included, and which while not absolutely essential fundamentally, do contribute so much to the worth of a house that the question of their inclusion should be given the most thoughtful consideration. It is recognized that the list which follows cannot be presumed to be complete and it is inserted for the value it may have as a guide to the one who wants to build something more than a mere structure. It is compiled from various sources including the expressions of individuals who have given the matter personal attention.

1. The principal rooms shall have a pleasant outlook, preferably a southerly exposure, the fullest advantage being taken of attractive views, especially towards the highway.
2. An office readily accessible to the driveway and to the barns, for the conduct of the business and the keeping of accounts. This should be available for both the master and the mistress.
3. A guest bedroom.
4. The location of one of the family bedrooms on the first floor to be used in case of illness or accident.
5. The separation of employees' bedrooms from the family sleeping quarters. If both male and female help is employed, the rooms for each should be completely separated.
6. A wash room to be used for laundry purposes, temporary fuel supply, and the storage of such things as coats, overalls, boots, tools, etc. This room should be placed next to the kitchen and on the direct route between barns and dining room, and the function of this room is to act as a sieve between the outdoors and the house and should be provided with a concrete floor, with drain and with laundry tubs.
7. A food pantry in connection with the kitchen.
8. Large screened living and dining porches.
9. A fire place in the living or dining room.
10. Separate bath or shower for the farm help.

In the preceding discussions no special differentiation has been made between the requirements of the owner's house and the tenant's house. Naturally, the investment house will not be so extensive as in the owner's and the opportunity for the inclusion of a large number of desirable features will not be so great. Nevertheless, it is imperative that the contentment of the tenant be made a subject of serious consideration and that his quarters be made as comfortable and attractive as consistent with circumstances. The tenant is a human being, and in order to work efficiently, must be housed comfortably. Under ordinary conditions, a simple house is entirely satisfactory, the size depending upon his family. In general, the problem of the tenant house is one, the plans of which include a general and family room that can be kept orderly, pleasant, and convenient to work in, with one or two rooms adjacent or above for sleeping quarters. The culinary arrangement need not be so elaborate; it should, however, be convenient. The tenant dwelling should be so simple, compact, and good looking that it can compete favorably with the comfort, convenience and attraction of the modern city home, for only in this way can the farm owner appeal to an intelligent type of tenant whose permanence is desired. The testimony of rural communities in which notable houses are provided for farm help indicate that in those communities there existed no labor shortage during the war. An efficient, attractive house is an economic measure for the farmer.

Conclusions

"Much has been said and written about the present high cost of building. It is true that a house of a given size today often costs twice os much as one of the same size would have cost twenty-five years ago; but this advance is due not alone to the increased cost of labor and material, but also to the fact that we are not comparing similar types of dwellings. We are comparing a house equipped with heat, running water, hardwood floors, and many closets, and frequently with electric light and build-in furniture, with a mere weather-proof structure built with single floors, no closets, and few or no modern improvements. Many more trades and much more equipment than formerly now go into the building of a comfortable house. It is the amount and the kind of equipment that increases the cost; a house thirty by forty feet may be made to cost three thousand dollars or ten thousand dollars, according to the beauty and finish of interior woodwork, floors and walls, the amount of plumbing, the number and kind of fixtures selected, or the kind of heating plant installed. The interest on this increased investment must be reckoned in distinctly human terms; increased joy of living, greater comfort, finer health and simpler housework for the woman, should be sufficient return for any man who loves his home and family."

History of Warrenite-Bitulithic Roads and Some Discoveries in Pavement Construction

Improvements and Inventions Leading to Better Results—Asbestos-Bitulithic and Double Re-Flushcoating Are New Ideas

By George C. Warren[*]

EARLY in the year 1901 the then entirely novel construction which has developed into Warrenite-Bitulithic, was first brought to the attention of your instructor, Professor Charles C. Brown, then Editor of Municipal Engineering, by its inventor, and the writer's brother, the late Frederick John Warren. It was then little more than a collection of embryonic thought in the inventor's mind engendered by fifteen years' practical experience in refining of asphalt and other bituminous materials, and in the laying of asphalt pavements and two years' practical experience in refining of asphalt and other bituminous materials and in the laying of asphalt pavements and two years' constant laboratory work in development of the new idea.

Fundamental Idea

Fundamentally, this idea was that better and more durable bituminous pavements than those in previous use could be produced by scientific grading of comparatively coarse grain mineral aggregate (either gravel or crushed stone) combined with high-grade asphaltic materials. Briefly, the principle of the grading of the aggregate which was in the inventor's mind from his first study of the matter, was to make the compressed aggregate as dense as possible, and coating the particles of aggregate, preferably heated, with specially prepared high-grade asphaltic cement, the result being true asphaltic concrete practically as dense and voidless as solid stone. This density is produced by combining particles of aggregate, ranging from the largest to impalpable powder, in such proportions that each receding size of aggregate is sufficient in quantity to fill the voids between the coarser sizes. With some surprise it was discovered that uniform sized grains of any given size contain the same percentage of voids or air space, these voids being approximately 5 per cent. of the bulk of compressed aggregate of such uniform size. In other words, a block or piece of stone broken into pieces of uniform size, produces a bulk double that of the solid rock. In crushing, therefore, a cubic yard of ledge rock is increased in volume to two cubic yards of closely screened uniform sized product, each separated uniform size containing approximately 50 per cent. voids. This is true whether two inch or larger size or as fine as one two-hundredth inch or even smaller, in which the individual voids are so small that they cannot be seen by the eye.

The first problem which presented itself to the inventor was to devise means of determining the proportions of varying sized grains which would reduce the voids to a minimum and apparatus to accurately make tests and equipment to practically produce the result in large quantities. In these early experiments the inventor was assisted by August E. Schutte, chemist, and Horace W. Ash, mechanical engineer, both of whom are still associated with Warren Brothers Company.

Void Testing Apparatus

Schutte invented the truncated cone for testing voids and determining proportions, it being found that all prior means of testing voids were quite inaccurate and unreliable. For instance, the old method of attempting to fill the voids with water only found a portion of them as the water did not expel the air from the smallest voids which constitute a very large proportion of the total voids. Another method of shaking the material in a cubical box was also inaccurate because the more the box was shaken, the more the fine material would sift to the bottom of the container and force the coarser particles upward to the point of "overflowing" the box. With the truncated cone having a base say six inches in diameter and top opening say half that diameter when the coarse particles of aggregate are shaken down, they are so wedged together and between the sloping sides of the cone, that power from below cannot force them up. The cones were first made of heavy sheet copper soldered at the bottom and sides, but the pressure produced by shaking the aggregate was such that it bulged the cone at bottom and sides. It was found necessary to make the cone of steel as heavy as 1/8 inch, securely riveted at bottom and sides. With this apparatus and violent shaking until no more material can be gotten into the cone and by using the correct proportions of all grades of aggregate from coarsest to finest the 50 per cent. voids in the uniform sized aggregate can be reduced to about 10 per cent. or to density within 10 per cent. of that of solid ledge rock. The cubical contents of the cone is known and the weight of compressed aggregate compared with the weight (determined by specific gravity) of a solid block of stone of the same cubical content and quality as being used for the test determines the per cent. of voids. The results vary with varying shapes and sizes of each quality of aggregate, consequently the "void test" must be made in the laboratory in advance of pavement construction, using in the test the identical quality and sizes of aggregate to be used in the practical construction. With the voids thus determined the next step is to determine the quantity of bitumen which is necessary to:

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[*] President, Warren Brothers Co., before highway engineering class of Valparaiso University.

(a) Fill all the voids and a slight surplus.
(b) Thoroughly coat all the particles of aggregate with the asphaltic cement.

By these methods and practices and scientific laboratory control we are able to regularly and practically accomplish (what no other form of monolithic bituminous pavement even approximately accomplishes) to wit, compression of approximately four (4) inches in depth of commercial ingredients into a compressed depth of two (2) inches.

From this brief description of the scientific rudiment it will be seen that the result is a highly scientific true asphaltic concrete having practically the density of solid rock.

Time at this occasion will not permit a description of the many other processes and apparatus for testing both the ingredients used and the completed pavement, also the improved detail methods of construction, all of which service is furnished by highly equipped laboratories with large force of employees, one of which laboratories is located in Cambridge, Massachusetts, and another at Portland, Oregon, at each of which in the working season approximately one hundred complete tests are made daily, including daily samples from all of the approximately two hundred places where Warrenite-Bitulithic roads are being simultaneously constructed during the busy season. Rudimentary laboratory apparatus is also maintained at each operating plant.

This is a part of the extremely important service which Warren Brothers Company gives in conjunction with the use of its patents.

Equipment Invention

Having overcome the difficulties of laboratory determination of ingredients to be used, the next difficulty was to devise equipment to practically produce the desired results as determined by laboratory operation. For this Horace W. Ash devised two general types of plant, which are diametrically opposite in their methods of accomplishing the same result, to wit:

(1) Stationary, semi-portable or railroad plant type, in which the aggregate first passes through rotary heaters in approximately the desired proportion; then is separated into several sizes by a sectional rotary screen of sufficient length and diameter to provide perfect separation; each size is kept separate in a sectional bin; accurately weighed in a box resting on a multi-beam scale and delivered to a "twin pug" mixer, in which the hot bitulithic (asphaltic) cement is added.

(2) Portable type, for which the several sizes of aggregate are accurately measured, before heating, into a batch of certain weight; delivered into a rotary drier heated by oil burner flame; the batch held together as a unit and delivered into a rotary mixer where the hot bitulithic cement is added. This type of plant in one unit, is permanently mounted on its own wheels and can be drawn by steam roller or horses. It is therefore available for use either alongside railroad or in quarry or gravel pit or alongside road being paved and is, therefore, most flexible in its operation.

It will be noted that each of these plant types is based on accurate proportioning of the several sizes of mineral aggregate into batches of certain size and each batch held as a separate unit until thorougly mixed with carefully weighed bitulithic cement and deposited in truck for hauling to the street.

Two hundred and twenty of these plants have been constructed and are regularly used throughout the United States and Canada. For construction of these plants very complete and extensive plants have been developed in Cambridge, Mass., and Portland, Oregon, having a combined annual capacity of about forty-five plants.

Foundation

Aside from improvements in the Warrenite-Bitulithic pavement surface, Warren Brothers Company has been progressive in the matter of foundation and has established the now quite generally accepted fact that tensile or beam strength is only one of the important considerations for a pavement base, and that given a well compacted, well drained sub-base the factor of beam strength becomes less important than:

(1) Resiliency.
(2) Thorough uniting of surface to base.

These considerations have taken the specific forms of:

(a) Economic conservation of old macadam roads and old pavements and foundations of other types of pavement by regulating the grade and contour and surfacing them with the dense, stable, solid, standard Warrenite-Bitulithic surface. In cases where the old macadam is of insufficient depth (say six (6) inches or more of solid road metal) it is reinforced by the addition of the required quantity of new stone spread and compressed over the old macadam.
(b) New Compressed Stone Base.
(c) Dense Bituminous Concrete Base.

During the past ten or more years these types of base have been practically used under such widely varying climatic and other conditions as to prove their economic utility beyond preadventure.

Gravel Aggregate

Beginning in the City of Portland, Oregon, ten years ago, clean, sound gravel has been used on the mineral aggregate of both Warrenite-bitulithic surface and bituminous concrete base to such a general and vast extent as to prove it to be fully equal to the best crushed stone.

Such gravel has the advantage over crushed stone of greater toughness and on account of its shape and toughness much less liability to fracture and displacement under traffic when exposed at the surface.

The theoretical objection held at one time that the rounded particles of gravel would not become firmly held in the structure and liable to displacement is thoroughly exploded by ten years' practical experience under widely varying conditions.

Surface Improvements

In the year 1910 Edwin C. Wallace, who has been associated with the speaker in paving organizations for more than twenty-five years, developed and patented the invention that the different sizes of the mineral aggregate in the wearing surface of a bituminous street pavement in addition to being properly proportioned should also be properly placed in their relation to each other, that is, with the coarser dense stable bituminous mixture at the bottom where the stability is most needed and the finer bituminous mixture near the surface, making the pavement densest at the top.

Patents granted him cover both an improved product and the method necessary to be used in making said product, which is a monolithic, bituminous concrete, pavement wearing surface, in which the coarse and finer mineral aggregate is so distributed throughout the mass that the product is a bituminus concrete structure, comprising "a rigid portion and a surface sealed to the elements."

This improved product is produced by first spreading upon the prepared foundation a bituminous concrete mixture, consisting of relatively coarse and finer-sized particles of mineral aggregate, which have been previously thoroughly coated with bituminous cement, then immediately spreading thereupon, a relatively thin layer of a bituminous mixture consisting of fine mineral aggregate and bituminous cement and then compressing these two bituminous mixtures together by rolling, so that the latter fine mixture is forced into the interstices between the larger particles of aggregate of the lower course. The compression by rolling being continued until the entire structure can be compacted no further and the result is a bituminous pavement wearing surface, the lower portion of which is composed of bituminous coated, large, medium and small sized particles of aggregate, so disposed as to impart stability and rigidity, and its upper surface composed of bituminous coated fine particles of aggregate, thoroughly bonded and anchored into the lower portion by compression, thus producing "a compact and substantially integral mass which is densest at the top.") This construction protects the coarse aggregate from penetration of moisture, also from fracture and displacement of the coarse aggregate by a thin surfacing about one-fourth inch of fine mixture extremely rich in soft bitumen, and therefore, extremely waterproof and wear-resisting, at the same time maintaining the essential solidity and structural strength of the dense, coarse aggregate wearing surface. Beginning with demonstration areas ten years ago, this construction has come to be the universally accepted improved standard Warrenite-Bitulithic wearing surface and has proved to have all the merit its inventor anticipated.

Asbestos-Bitulithic

In the year 1916 Schutte applied for patent, which was granted in 1918, for a pavement and method of laying same, using asbestos fibre combined with mineral aggregate along certain scientifically determined lines.

Owing to difficulty in securing economic supply of asbestos under war and post-war conditions, the general introduction of this improved construction has been deferred, but sample demonstration areas have been laid during the past three years in several sections of the country, particularly under the rigorous climatic conditions of New England

One commercial contract was executed in New Bedford, Mass., in the year 1919.

Enough work has been done and in use for a sufficient term to prove its practical utility. Of course the asbestos adds somewhat to the cost, but at normal prices for asbestos, this is fully compensated by its advantages.

The presence of the indestructible asbestos fibre adds toughness to, and overcomes the brittleness of, the asphaltic cement and wearing properties of the pavement structure, to which it imparts very remarkable and desirable qualities.

While the proportions of bitulithic cement and varying sizes of aggregate employed in the bitulithic surface are modified to meet the conditions imposed by the asbestos, none of the well-established principles of the otherwise latest improved bitulithic construction are in any way sacrificed or lost. The name given to the construction is "Asbestos-Bitulithic." It offers great promise for further meeting the requirements of modern traffic conditions.

Double Re-Flushcoating

In every type of pavement the time comes when its surface becomes dry and roughened under traffic. In the case of bituminous pavements on the theory of "A stitch in time saves nine," a double re-flushcoating method, devised and patented by Wallace, affords a most economic method of renewing to its original vitality the old partially deteriorated surface.

Briefly stated, the process consists of:

1st. Thoroughly cleaning the old surface.

2nd. Repairing holes and depressions, if any.

3rd. Painting the surface while clean and dry in warm weather with cold asphaltic paint made of bitulithic cement liquified by light solvent, called "Liquid Refluschcoating Bitumen," which is allowed to remain without further application, for a few hours and until the liquid asphalt has well penetrated into the old surface and the volatile solvent has evaporated.

4th. Give the surface a second painting of melted hot "Hard Re-flushcoating Bitumen" of the proper consisteny.

5th. While the second coating of bitumen is still hot, spread and roll sand or crusher screenings.

The work requires only about a total of one-fourth gallon per square yard of the two grades of re-flushcoating bitumen, which are supplied ready for use at per gallon prices, including license to use the patents and Warren Brothers Company service charges.

Other Improvements

Several other important improvements are now in process of demonstration but, pursuant to the policy of Warren Brothers Company, nothing is said publicly of its improvements until they have been sufficiently tried in practical use to demonstrate their economic utility.

According to a financial statement received by the Contract Record, the operation of Public Utilities in Calgary, Alta., has been very successful. A very healthy condition is evident with surpluses in all departments. For the year ending December 31, 1919, these are as follows: Electric light and power department, $24,219.43; street railway department, $42,232.95; water works department, $9,742.32.

Good Homes, Ltd., has been formed to carry on the business of builders and contractors. The capital is $49,000 and the head office Montreal.

Sawyer Hollow Wall System to be Made in Winnipeg

The Manitoba Self-Locking Concrete Wall Co., operating the Sawyer System of hollow concrete wall construction has been formed to operate in the province of Manitoba and the territory eastward as far as fifty miles east of Port Arthur. They are installing their plant in Winnipeg, off Portage Ave., west of the Ford factory, and expect to be operating early in May. This plant will be one of the many established throughout the territory controlled by them. The personnel of the company includes Mr. John W. Sifton, Douglas Laird, Eward Kelly, Mr. Haven, and other prominent grain exchange operators.

The company look forward to erecting many country grain elevators on the Sawyer system. The prospects for construction in Winnipeg are such that they expect to be operating three or four most modern plants this year and to have at least a 15,000 feet per day production before the season is over.

Mr. Chris. Simpson, one of the company, is supervising with Mr. Ross, the installation of this plant, and will then turn over the management to a competent engineer. Orders for well over 100,000 feet of their products are already in hand.

Anglin-Norcross, Ltd., Completes Successful Year, Following Reorganization

Anglin-Norcross, Ltd., Montreal, have completed the first year of the reorganization by which the firms of Anglins, Ltd., and the Canadian branch of the Norcross Bros. Company, of Worcester, Mass., were amalgamated. According to an official statement, in the first twelve months after the amalgamation over $3,500,000 of new contracts were signed up. Over $1,000,000 of uncompleted work was carried over into 1920, and in the first three months over $1,000,000 additional new work was taken on.

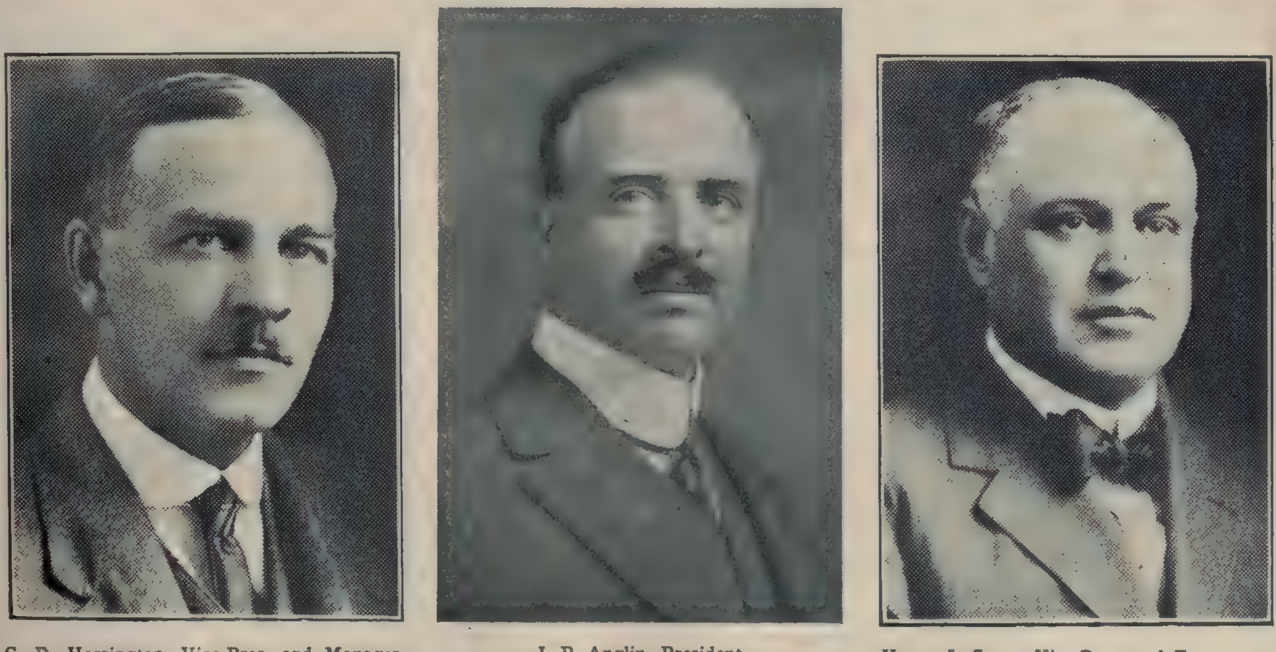
Some contracts recently signed up are for the following firms and institutions: Singer Sewing Machine Co.; Belding Paul Corticelli, Ltd.; Goodwin's Ltd.; Merchants Bank of Canada, Toronto; Canadian Cottons, Ltd., (three plants in Ontario and Maritime provinces); Children's Memorial Hospital; marble work, Parliament Buildings; Ottawa Steel Co. of Canada; Halifax Shipyards; Bovril, Ltd., Montreal Abattoirs, Ltd.; Henry Birks & Sons, Ltd., (Halifax); Canada Amusement Co., (Imperial Theatre film building), etc.

Fellowships in Highway Engineering and Highway Transport

The Department of Civil Engineering of the University of Michigan announces that the following fellowships are available during the collegiate year 1920-1921.

The Roy D. Chapin fellowship in highway transport is offered to provide for the investigation of an approved subject relative to highway transport. It pays the sum of $250 with an allowance of $50 for expenses. The Roy D. Chapin fellowship in highway engineering is offered to provide for the investigation of an approved subject relative to hard surfaced roads and pavements. It pays the sum of $250 with an allowance of $50 for expenses. Two Detroit Edison fellowships in highway engineering are offered for the investigation of approved subjects relative to moderate cost country roads. Each fellowship pays the sum of $250 with an allowance of $50 for expenses.

A Fellow must hold a bachelor's degree from a college of recognized standing and he must enroll as a candidate for the degree of Master of Science or Master of Science in Engineering and be in residence for one of the following periods: First semester (October to February); winter period (December to March); second semester (February to June). Applications should be sent to Arthur H. Blanchard, Professor of Highway Engineering, University of Michigan, Ann Arbor, Michigan, not later than September.



C. D. Harrington, Vice-Pres. and Manager J. P. Anglin, President Henry J. Gross, Vice-Pres. and Treasurer

Three executives of Anglin-Norcross, Ltd., Montreal which has completed its first year of business following the amalgamation of Anglins, Ltd. and Norcross Bros. Co.

Detecting Leaks in Underground Pipes

Instruments and Methods for Determining Location of Water Losses—Sound Detectors, Chemical Methods, Wireless Locator

METHODS for the detection of leaks in underground water pipes are numerous, but it is seldom that one can find a description of as many of them contained in a single paper as there were in the one presented by H. E. Babbitt, assistant professor, municipal and sanitary engineering, University of Illinois, before the recent annual meeting of the Illinois section of the American Waterworks Association at Urbana, Ill. The following notes from Engineering and Contracting review most of the various methods described in this paper.

The simplest method for locating a leak is by observation, but it is not always true that the leak is directly below the point of observation. A sounding rod is useful in many cases. A ½-in. rod about 5 ft. long can be driven down to the pipe in most soils. If the rod on withdrawal is moist, the indications are that the leak is farther up grade, if not, the leak has been passed and lies in the opposite direction. By driving the rod a few times it is often possible to isolate the leak at once. An aquaphone used in connection with the sounding rod locates the leak by finding the place on the pipe where the loudest noise is produced. The aquaphone is an instrument that transmits the sound waves of the water issuing from the leak through a metallic diaphragm to the ear. Other similar instruments make use of electric currents for amplifying the sound waves. In all of these methods, however, direct contact with the pipe is necessary, generally through a rod driven in the ground, or other metallic connections to the mains.

Sound Detectors

Another form of leak locator is a sound producing instrument that does not require direct contact with the pipe. A very delicate sound detector is set up on a 4-legged brass table which rests on the surface of the ground, and is protected from air currents by placing a box over it. The vibrations set up in the detector are converted to electric waves which are transmitted through an amplifier to a very sensitive telephone receiver. The instrument is so sensitive that it will detect the sound of a leak through the pavement and the ground at the ordinary depths to which water pipes are buried.

The phenomenon of water hammer is useful in locating a leak in a water pipe. It is well known that if a valve in a pipe line is closed quickly a pressure is set up in the pipe. This pressure is called water hammer. It differs from the effect caused by a blow in that the pressure is maintained for some time. A wave of high pressure travels from the valve up the pipe to a point of relief and a wave of low pressure then returns to the starting point at the valve. The pressure at the valve fluctuates above and below normal until the disturbance has become stilled by the friction of its passage through the pipe, and the pressure returns to normal. Intermediate discharges between the valve and the point of relief will cause fluctuations in the pressure at the valve after the water hammer has been created.

The speed at which the wave travels is affected by the diameter of the pipe, its material, and other factors and varies between 3,600 and 4,200 ft. per second. In the application of this phenomenon to the location of a leak, the approximate location of the leak should be determined and the line of pipe on which the leak is located should be isolated by the closing of valves so that it is connected to only one large service main, preferably much larger than the pipe in question.

Employing Water

It may be necessary to shut off service connections or to apply the method at night when the service pipes are not drawing water. A quick shutting off valve is attached to a hydrant so located that the leak is between it and the water main. The distance from the hydrant to the connecting main along the pipe line should be measured accurately. A delicate recording pressure gauge is attached to another nozzle on the hydrant. The dial of this gauge is evolved by clock work. Time is recorded by the vibrations of a tuning fork.

After the instruments are connected, the valve is opened and water allowed to flow from the hydrant. The valve is then closed suddenly. On the closing of the valve, the pressure line on the diagram will jump up. The pressure will remain at this height until a slightly relieving wave has returned from the point of the leak when it will drop a little. The pressure will then remain constant until a low pressure wave has returned from the point of relief. The exact location of the leak is then determined by proportional distances from the diagram.

Chemical Method

A method requiring the use of chemicals was suggested by T. J. Hoxie in the Journal of the New England Waterworks Association, Vol. 27, page 307. The leak is located tentatively within a certain section of pipe which is then isolated as in the preceding method. It is essential that all service connections be closed. A corporation cock is tapped into the main somewhere above the leak. To this is connected a 6 or 8-in. length of 2 or 3-in. pipe and a valve. Two or three pounds of caustic soda are inserted in the tube, the large valve closed, and the time of opening of the corporation cock noted. Samples are collected at various points along the line and tested for alkalinity with phenolphthalein. As soon as the alkalinity is found at any one point it indicates that there is a leak beyond that point because the flow created by the leak has carried the chemical down. Finally a point will be reached where the alkalinity does not appear. The indication is that the leak is somewhere between this point and the point at which it was last found. Water is withdrawn at the point at which the alkalinity has not appeared and the quantity withdrawn before the alkalinity does appear is carefully measured. This quantity, divided by the volume per unit length of the pipe will give the distance to the leak. Any number of leaks can be determined in this fashion.

An ingenious method based on volumetric displacement was used for the location of a leak in a pipe line in Chicago. A piston was made which fitted the inside of the pipe. A Y-branch was inserted in the pipe line and the piston was put in the pipe through this branch. A cable attached to the piston was passed through a packed joint in the plug closing the Y-branch. The water was then gently turned on in the pipe sufficiently to keep the piston moving. When it had reached the leak it stopped, and the length of the cable measured the distance to the leak.

A simple method for the location of a leak in a submerged pipe is to dump a quantity of bluing in the line. The appearance of the bluing in the river or harbor will locate the position of the leak. Other equally difficult methods may be as effective as the more scientific methods just described

If the location of the pipe line itself is unknown there is an instrument available known as the wireless pipe locator by which the exact location of the pipe can be determined. An electric circuit is made by connecting two points on the pipe line by an electric wire. A battery and vibrator are put in this circuit, the vibrator serving to interrupt the current rapidly. An induction coil and a detecting coil connected to a telephone receiver are carried in the hand. When the induction coil held in a horizontal position is brought into the vibration electric field set up by the electric circuit through the pipe and wire a singing noise is heard in the telephone receiver. The volume of sound increases until directly over the pipe when it ceases altogether. If the coil is then turned in a vertical position the loudest sound is heard.

Hydrated Lime Improves Cement Products

Increases Moisture Content Without Altering Consistency of the Mixture—Produces Watertight Concrete

THE manufacture of concrete products is developing into a profitable business of rather large proportions. This is due partly to the fact that those financially interested recognize that the industry offers tremendous possibilities which can only be destroyed by the shortcomings of the manufacturers themselves. There are innumerable demands for concrete products in almost every locality; the great bulk of the materials entering into the products are found locally; the labor cost is not excessive, and the initial investment is not large.

With the foregoing facts in mind, manufacturers came to realize that one more element was necessary to place the industry on a well-established, profit-paying basis. This element is production of quality; if the industry is to thrive in a manner commensurate with its possibilities, it must of necessity be built upon a solid foundation of quality and durability. With this end in view the National Lime Association have issued a booklet, the object of which is to acquaint all manufacturers with the advantages to be gained by using judicious quantities of hydrated lime in concrete products, working toward the end of maximum strength and durability at a minimum of expense. Some extracts are given below:

Important Properties of Artificial Stone

The first requisite is strength. Any product must have sufficient strength to withstand all reasonable loads that may be imposed. Any excess strength which may be developed over that which is absolutely necessary, will naturally be a factor of safety. Here is an important point—the manufacturer who produces the product that develops the greatest strength, other things being equal, always has an excellent selling argument over his competitor.

Another requisite in some types of products is water-tightness. Its importance depends more particularly upon the purposes for which the products are to be used.

Development of Strength

The strength of the product may be increased or decreased by varying the quantity of cement used. It is customary, in manufacturing cement products, to use a sufficient quantity of cement to produce an article that will pass certain specifications. This is quite logical, but let us consider how strength may be increasd without the use of additional cement. It can be done by increasing the efficiency of the cement through proper regulation of the water content.

It is common practice to manufacture certain classes of concrete products by what is known as the semi-dry process; that is, the mixtures used are of a very dry consistency. The reason for this is economy in handling, thus tending to reduce manufacturing costs. As this semi-dry consistency is the standard method in many factories, and particularly those making building blocks, any increase in the free water content is undesirable, so there remains but one method of augmenting the strength, namely, increasing the efficiency of the cement.

There is a well-established theory in concrete practice which, during the past few years, has been proved by several of the foremost scientific concrete investigators in the United States—that the strength of concrete containing a given amount of cement is governed almost entirely by the quantity of water used in mixing. These investigators have conclusively proved that with a given aggregate, maximum strength of concrete containing a given quantity of cement can be produced by using an exact quantity of water. Any increase in free water content over the exact amount necessary to produce maximum strength will cause a decrease in strength. It has also been proved that a decrease in strength results when a quantity of water less than the exact amount is used.

Semi-Dry Process

It has already been pointed out that the semi-dry process is commonly used for certain classes of concrete products. In this dry consistency there is an insufficient quantity of water to cause maximum strength to be developed, and for this reason the products do not develop as high strength as is commensurate with the quantity of cement they contain.

In order to develop high strength, it is customary, in many factories, to use the water-spraying or steam-curing methods. The water-spraying method is simple and needs no comments, except that care should be exercised to see that the flow of water is not so strong as to damage the products during their tender age.

Steam-curing produces a combined condition of moisture and warmth, both of which act toward development of high strength. The products are left in the steam room, which is usually held at a temperature around 110 deg. F. for a period of two or three days, when they are removed to the storage yard for seasoning until sold.

When reference is made to increasing the efficiency of the cement in the foregoing, it is not intended to refer to water-spraying or steam-curing but by causing more nearly complete hydration of the cement after the effects of the two methods mentioned have ceased.

Water Carrying Capacity of Hydrated Lime

A given weight of hydrated lime requires about three times as much water to produce a paste as the same weight of portland cement so that for each ten pounds of lime used in a mixture for concrete products, there is carried into the mix approximately as much water as would be carried into it by thirty pounds of cement. This water is carried in by purely mechanical action on the part of the lime and the consistency is not changed. The value of this point should not be overlooked—increasing the moisture content without altering the consistency of the mixture.

Advantages of Hydrated Lime in the Semi-Dry Process

It has already been stated that concrete products are made by the semi-dry process in order to take advantage of economy in handling. In the manufacture of such products, it is customary to handle them almost immediately after being moulded. Concrete of a wet consistency requires considerable time to harden so that it can be safely handled; hence, in order to save time, many manufacturers have adopted the semi-dry process. Heretofore, it has been necessary to use a dry consistency for the manufacture of these products so they could be handled as early as is necessary and at the same time have a minimum of breakage. When hydrated lime is used, it carries a considerably larger volume of water into the mixture, **but does not change the consistency**, so that the products after moulding, can be handled without loss of time and without any more breakage than when the usual dry mixture process is used.

It has been pointed out that one reason concrete products are not stronger is because the cement frequently works at low efficiency due to an insufficient quantity of moisture being present to cause complete hydration of the cement. When hydrated lime is used in the mixture its high mechanical water-carrying capacity is the direct cause of more nearly completed hydration of the cement.

Cement will hydrate and continue to increase in strength just so long as moisture is available to re-act with the cement. As soon as conditions are such as to make it impossible for moisture to form contact with the cement, hydration ceases, with the consequent result that development of strength also stops.

In the water-spraying and steam-curing methods, the moisture, which is available during the period of treatment, causes a rapid increase in strength. After the products, which do not contain hydrated lime, are put in the storage yard, however, the wind and sun rapidly dry them out and little strength develops from that time. The property that hydrated lime possesses of absorbing and holding water mechanically is, therefore, of material benefit, inasmuch as the hydrated lime holds this water so that it may be drawn upon by the cement in the process of hydration and so make for increased ultimate strength.

Both theoretically and practically it has been fully demonstrated that the addition of hydrated lime to the mixture is of particular benefit in concrete which is subjected to conditions that will cause it to dry out rapidly.

About Water-Tightness

It is very often not only desirable but necessary for concrete products to be rendered water-tight. The various uses to which these products are placed make it almost advisable that all concrete products be made water-tight. Concrete products are impermeable to water, or water-tight, when they do not permit the passage or flow of water through the pores or voids. If the pores or voids between grains are sufficiently large and connected from surface to surface of the walls, the concrete will be permeable to water.

It is only natural that any material or method the purpose of which is to make concrete water-tight must have for its aim the elimination of structural defects and visible voids and the reduction of the smaller passages by diminishing their size and filling them with finely distributed material of a colloidal nature.

Against limited pressure concrete may be made reasonably water-tight without the use of any material other than portland cement and the aggregates. This, however, is possible only with sufficiently rich mixtures of the proper consistency, selected and carefully graded aggregates, supervision and workmanship of a character that is both extremely rare and expensive. Of course, the addition of any material will not compensate for carelessness, but should assist in producing satisfactory results with ordinary care and less labor.

Many substances have been added to concrete, with a view to making it water-tight, with varying degrees of success.

There are certain technical and economic criteria which determine the degree of usefulness of every structural material and the study of a large number of concrete structures, both in course of erection and during years of service, has shown that a waterproofing material, to satisfy both technical and economic requirements, should possess the following properties:

1. It should in no way injure the concrete, either chemically or physically.
2. It should be preferably of a character chemically similar to that of cement.
3. It should enter the mixture in its most effective form and not rely for its waterproofing quality on chemical reactions that have to take place after it is brought in contact with the ingredients of the concrete.
4. It should be permanent and not subject to decomposition or decay, and, therefore, it should be a mineral rather than an organic compound.
5. The material should be finely divided, bulky, and preferably of a colloidal nature, so as to lubricate the mass during handling and placing and act as a void filler in the hardened concrete.
6. It should readily mix with water and adhere to the other ingredients of the concrete.
7. It should be convenient to handle and easy to proportion and incorporate in the mix.
8. It should be inexpensive so as not to increase the cost of concrete materially.

No. 17

Canada's Contractors—J. A. Grant

In the person of Mr. J. A. Grant, president of J. A. Grant & Company, Ltd., engineers and contractors, St. John, N. B., the "Contract Record" has the honor of presenting in this series one of the best known and most widely experienced contractors of Eastern Canada. Mr. Grant has been connected with several well known contracting concerns, and during the last few years, as head of the company bearing his name, he has been responsible for a very large number of substantial contracts in the Maritime Provinces.

Mr. Grant is an Englishman by birth. He was educated at the Merchant Venturers Technical College of Bristol, and after leaving college he joined the Hard Stone Firms, Limited, of the same city, as assistant to the manager, in which capacity he carried out office work in connection with quarrying and stone working operations. From 1899 to 1902 he was articled with Messrs. Drake & Pizey, architects and sureyors of Bristol, being engaged during this period on work in the west of England, including the J. S. Fry & Sons' chocolate factory, Messrs. Lysaghts, Limited, Iron Works, the Capital and Counties Bank and several churches. He then served for five years with Messrs. S. Pearson & Son, Limited, contractors, London, England, as civil engineer on the Great Northern & City Tube Railway in London, and on the Malta Breakwater in the Mediterranean. In 1907 he joined P. Lyall & Sons, general contractors of Montreal, serving as superintendent in charge of fourteen harbor sheds at Montreal and extension to the Montreal Post Office. A year later he became connected with Stanley Gollick & Company, reinforced concrete contractors, New York, and during two years with this firm was in charge of reinforced concrete work on the new Post Office, New York, Chateau Laurier, Ottawa, and other work in New York and Canada. From 1910 to 1913 he was again with P. Lyall & Sons, as superintendent in charge of construction of the National Bridge Works, at Longue Point, Que., Dominion Express Building, Montreal, and an extension to the Algonquin Hotel, St. Andrew, N. B. For one year he was general superintendent for this concern in charge of Montreal work. In 1913 he became superintendent for E. G. M. Cape Co., Ltd., in charge of the construction of the Armstrong-Whitworth plant at Longueuil, the Atlantic Sugar Refineries, St. John, N. B., and the new government wharves at West St. John, N. B.

Mr. Grant, in 1915, formed the firm of Grant & Horne, which was taken over in 1919 by their successors, J. A. Grant & Co., Ltd. As stated previously, this concern has to its credit a number of extensive contracts, including: Extensions to Atlantic Sugar Refineries, T. McAvity & Sons' new shell plant, conveyors for the Dominion Government, conveyors for Canadian Pacific Railway, street paving for the Canadian Pacific Railway, two molasses tanks for Crosby Molasses Company, all of St. John, N. B.; roundhouse for Canadian Pacific Railway Company, Beaconsfield School, new grain conveyors for Public Works Department, a baggage shed for the C. P. R.—this was a structure on piles, 500 ft. long x 87 ft. wide, which was erected in record time of fifty working days, during the winter of 1919—at West St. John, N. B.; Fraser Memorial Sunday School and residences and stores at Fredericton, N. B.; two 3000-ton wooden steamers, "War Fundy" and "War Moncton," for the Imperial Munitions Board, the building of one four-masted schooner, the "Cutty Sark," and several other smaller jobs.

Mr. J. A. Grant

Mr. Grant is an associate member of the Engineering Institute of Canada and also an associate member of the American Society of Civil Engineers. He is greatly interested in organization among contractors and attended the first conference of the Association of Canadian Building & Construction Industries, and is at present very actively interested in the newly formed branch of that association in St. John, N. B.

9. It should be a staple material produced in all parts of the country, rather than a specialty.

10. It should be obtainable wherever portland cement is sold and used.

A moment's reflection on the part of the reader will cause him to determine just how well-hydrated lime fulfills these requirements.

A few years ago the U. S. Bureau of Standards, Washington, D. C., made an extensive investigation into the effectiveness of waterproofing materials. Over forty materials were used, including hydrated lime. The result of the investigation is reported in Technologic Paper No. 3 of the United States Bureau of Standards, and we quote herewith a statement taken from the summary of the report mentioned. This conclusion refers to the use of hydrated lime:—

"This is the most efficient medium employed and resulted in an almost impermeable mortar at the two weeks' test. Its value is probably due to its void-filling properties and the same results could be expected from any other finely ground inert material, such as sand, clay, etc."

While from the standpoint of producing a watertight concrete, the various substances mentioned other than hydrated lime might prove equally effective, their use as a substitute for hydrated lime prove prohibitive from the standpoint of economy when an effort is made to produce sand or clay in as finely divided particles as hydrated lime.

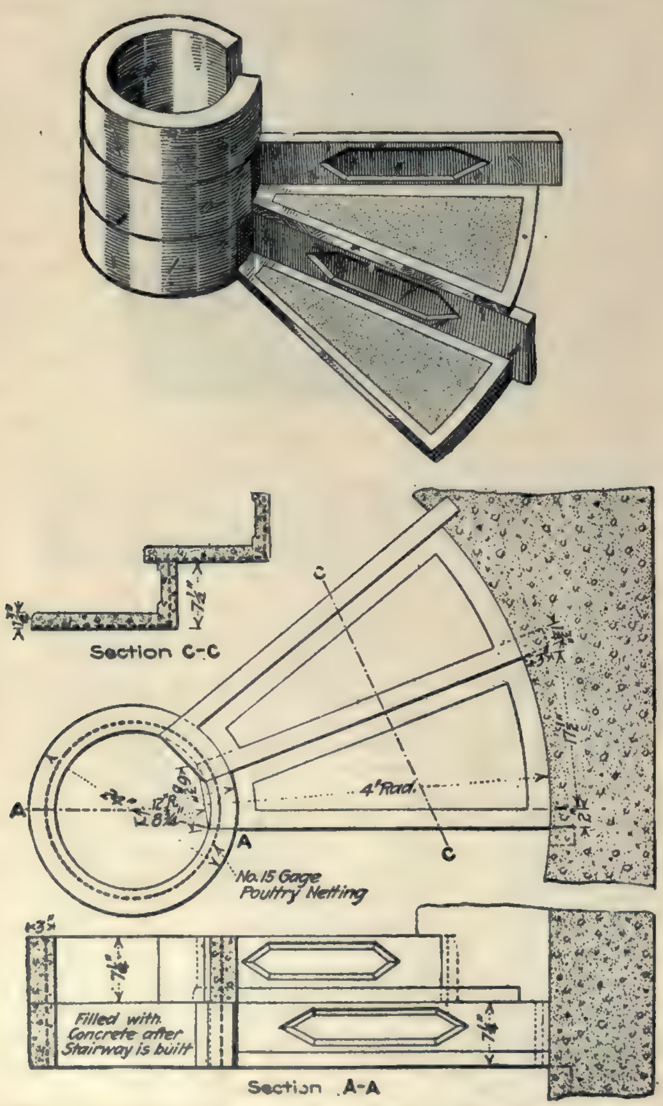
Our recommendations for a 1-5 mix are 8 pounds of hydrated lime per bag of cement; 1-6 mix, 10 pounds hydrated lime: 1-7 mix, 12½ pounds hydrated lime can be accurately and conveniently measured. A 6-quart pail, heaping full, holds 8 pounds; an 8-quart pail holds 10 pounds; a 10-quart pail holds 12½ pounds.

Hints for the Contractor

That May Save Him Time and Money—We Will Pay for All Accepted Items—Send One In

Spiral Stairway Made of Precast Concrete Members

IN the new Welland Canal locks a mooring gallery runs longitudinally through the lock wall for its full length at an elevation about 30 ft. below the top of the well. Through openings into the lock from this gallery boats are moored during the locking operations and as the water rises the lines are cast off of the bollards and the men go up through stairways to the top of the lock. These stairways for the larger part of the 30-ft. depth have been built in spiral form of precast concrete members, according to the details shown in the accompanying drawing from Engineering News-Record.


Section C-C
A
C
4' Rad.
A
C
No. 15 Gage Poultry Netting
7½"
3½"
Filled with Concrete after Stairway is built
Section A-A

Details of narrow precast concrete stairway for Welland canal lock wall

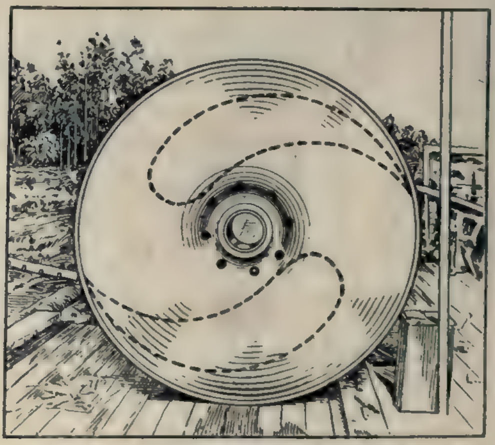
In building the lock a cylindrical opening 8 ft. in diameter is left from the mooring gallery floor to the lock-wall top. With the exception of the lower 6 ft., which is in straight stairway, the whole staircase is in spiral form rising around a central concrete column made up of precast hollow cylinders with each step a precast concrete piece comprising a tread and the next higher riser.

The supporting cylinder blocks are each 2 ft. in outside diameter with 3-in. walls 7¼ in. high,, reinforced with No. 15 gauge chicken wire. A radial opening is left in the wall of this annular ring of sufficient size to admit the stair unit. This stair unit, as shown on the detail, is sector shaped with the riser protruding 3 in. on top of the first and turned radially in a horizontal plane just sufficient to place the opening in the proper position to engage the next higher stair unit. The staircase is erected in this manner in successive units clear around the double turn to the top of the lock wall. After all the units are placed the opening in the cylindrical block support is filled with mass concrete.

In addition to the precast pieces for the spiral stair unit a precast tread 12¼ in. wide and 1¾ in. deep is made for the straight approach section to the spiral staircase.

Centrifugal Pump for Handling Tree Stumps

IN the process of cutting a new canal to drain low-lying land near New Orleans, some very difficult material has had to be excavated, and the work has entailed considerable alterations to the dredgers employed. The canal, which is 150 feet wide by 30 feet deep below low water, crosses a level tract of land covered, at one time, by cypress trees. At the time the work was begun there was a fresh growth of young trees, while test pits showed that they were underlaid by a great mass of old cypress stumps which had fallen and sunk in the morass.



Impeller of pump for handling large solid bodies

Suction dredgers, with rotary cutters, were put to work on this material, but, as was to be expected, quickly clogged up with stumps and roots, and were stopped on this account for over 25 per cent. of the working hours. After various expedients had been tried, a new impeller for the pump of one of the dredgers was designed by Mr. A. B. Wood, the mechanical engineer to the Sewerage and Water Board.

This impeller, of which we give a sketch, taken from the Engineer, follows somewhat on the lines of the primitive centrifugal pump formed of two bent radial tubes. There are only two impellers, shaped like the pattern on a Paisley shawl, with the result that the passages through the pump have very easy curves and will permit the passage of large solid bodies with the water.

The dredger on which this impeller was tried had a suction branch 22 in. in diameter and an 80-inch impeller. Both these dimensions were retained in the alterations, and the plant in general unaltered. When the new pump was put to work, the output of the dredger was increased by about three times during the time when it was actually excavating, while the delays caused by clogging of the suction were reduced by one half. The average excavation amounted to 445 cubic yards per hour, and it appears from some results of tests in the paper that the efficiency of the pump and engine was of the order of 43 per cent., while a photograph of some of the material discharged by the dredger suggests that it can handle tree stumps up to about 5 ft. long by 18 in. in diameter.

Rhodes, Curry, Ltd., Separates from Canada Car and Foundry Co.

A business reorganization that is of importance in Nova Scotia, and not without interest in other parts of Canada, is that of the Rhodes, Curry Company, Limited, which now becomes simply Rhodes, Curry, Limited, divorced entirely from the Canada Car & Foundry Company, of which for some years it has been a subsidiary. It is understood that the latter company was not unwilling to cut away from everything except the making of cars and therefore it was convenient to allow the works at Amherst to be dissociated from the enterprise which has its headquarters at Montreal. The operations of Rhodes, Curry Company will be completely centralized in Amherst and branches which have been established at other points, it is understood, will be closed. This means the perpetuation of what has become one of the oldest of the industries of Nova Scotia.

Graduate Short Period Courses in Highway Engineering

During the months of December, 1920, to March, 1921, inclusive, the University of Michigan will offer the following seventeen graduate short period courses in highway engineering and highway transport. Each course will consist of thirty lectures and be given in a period of two weeks. The time schedule of the courses will be announced later. Each course will count as two hours credit towards the total of twenty-four hours required for the Master of Science degree. The fee for each course will be $10.

American and English highway transport methods; highway transport surveys; interrelationship of highway, railway and waterway transport; American and English highway traffic legislation and regulations; highway transport management, costs and record systems; highway transport seminar; highway engineering financing, administration and organization; highway engineering theory and design; highway laboratory; bituminous materials; grading machinery and operation; earth, sand-clay, gravel and broken stone roads; bituminous surfaces and bituminous pavements; brick, cement-concrete, stone block and wood block pavements; highway specifications, contracts and jurisprudence; highway structures; highway engineering seminar.

In the Interests of Safety

Rewards totalling two thousand five hundred dollars are now offered for the arrest and conviction of the motorist who struck down the late C. A. B. Brown. The city has authorized $500; the Ontario Motor League $1,000; the Ontario Safety League $500; and the Toronto Automobile Trade Association $500. The Safety League is working on the question of reward and expects that other public-spirited organizations will increase this total materially.

Trade Incorporations

Wood Pipe Company, Ltd., with head office at Montreal, capital $50,000.

Concrete Brick Company of Canada, Limited, with head office at Windsor, Ont., capital $40,000.

Caledon Brick Company, Ltd., with head office at Toronto, capital $100,000, to manufacture brick, tile, slate, etc.

William I. Bishop, Limited, with head office at Montreal, capital $1,000,000 to carry on the business of general contractors.

Brigden Brick & Tile Company, Ltd., with head office at Brigden, Ont., capital $40,000, to manufacture brick, tile, sewer pipe, etc.

Windsor Construction Company, Ltd., with head office at Windsor, Ont., capital $40,000, to carry on the business of building contractors.

A group of houses designed for Trenton, Ont., Housing Commission by Wm. Lyon Somerville, Architect, of Toronto

Mainly Constructional

East and West—From Coast to Coast

The Windsor Hotel, Niagara Falls, one of the largest in the city, has been sold and will be converted into an apartment house with 25 suites.

Practically all branches of labor have reached agreements on the wage question with the contractors at Moncton, N. B., and building activities have been resumed after a brief tie-up.

A new firm, Messrs. MacKenzie & Company, roofing and sheet metal contractors, have opened a shop at 339 N. Norah St., Fort William, Ont. Mr. G. W. MacKenzie, well known in local contracting circles, is manager of the new concern.

Building permits issued at Hamilton last month totalled $779,500 in value, or an advance of $296,190 for the corresponding month last year. Last month's figure is the second largest in the history of the city, exceeded only by that of September, 1919, when permits went over the million dollar mark.

Building figures from Winnipeg for the month of April show a big increase over the corresponding month in any year since 1914, in which year building was at its height in Winnipeg. A total of 313 permits were issued for an estimated value of $2,901,300. Last year's figure for the month of April was $239,600.

Mr. H. Frank Bird, secretary of the Good Roads League of British Columbia, recently completed a tour of several of the principal cities of the province for the purpose of spreading the propaganda of good roads and to further the establishment of Good Roads Associations at these different points.

City Engineer Parsons, of Peterboro, Ont., returned to that city recently after a short trip to New Orleans and Houston, Texas, where he inspected the sewage disposal plants and pumping equipment, and obtained some very valuable information on the working of the activated sludge systems of sewage disposal in use in these cities.

The plant of Baldwin's Canadian Steel Corporation at Toronto has been forced to discontinue operations indefinitely owing to a shortage of electric power. The contractors on the construction of a half million dollar addition to the present plant have also ceased work and things will remain at a standstill pending the decision of the directors of the corporation in England.

At the annual meeting of the Peterboro, Ont., branch of the Engineering Institute of Canada, Mr. C. E. Sisson occupied the chair in the absence of Mr. R. H. Parsons, who was out of town. The most important item of business was the election of officers for the coming year, which resulted as follows: Honorary chairman, R. B. Rogers; chairman, R. H. Parsons; vice-chairman, P. L. Allison; secretary, R. L. Dobbin; treasurer, D. L. McLaren; committee, C. E. Sisson, P. P. Westbye, J. McIntosh, J. D. W. Magie, C. H. Rogers.

Trade Incorporations

The Webb-Trew Construction Company, Ltd., with head office at Midland, Ont., capital $20,000.

Foam Lake Cement Block, Brick and Tile Company, Ltd., with head office at Foam Lake, Sask., capital $20,000.

The Bannon Company, Limited, with head office at Toronto, capital $40,000, to deal in engineering supplies and carry on the business of a construction company.

Personal

Capt. Allan Curry was re-appointed sanitary inspector of Sydney, N. S., at a recent meeting of the Local Board of Health.

The newly appointed Housing Board at Campbellford, N. B., is composed of Messrs. N. C. McKay, A. H. Ingram, and H. C. Matthews.

The new firm of Ontario Builders, Ltd., have opened offices in the Manning Chambers, Toronto. Mr. A. M. Shook is manager of the new concern.

Mr. H. Randal, district engineer of the C. P. R. for British Columbia, has returned to Vancouver after a five months' trip to England and the Continent.

At a recent meeting of the city council of Peterboro, Ont., Ex-Mayor G. H. Duncan was appointed to the Utilities Commission, succeeding the late W. H. Moore.

At the recent appointing of town officers at Campbellford, N. B., Mr. W. J. S. Walsh was appointed town engineer; Mr. Chas. Parker, street commissioner, and Mr. John Andrew, building inspector.

Mr. R. H. Simonds, secretary of the Board of Trade at Fredericton, N. B., has been appointed a member of the Housing Commission, replacing Rev. D. W. Roberts, who left the city recently.

Mr. F. C. Wightman has resigned as town engineer of Amherst, N. S., to accept a position on the Provincial Highway Board. Mr. Wightman will be superintendent of roads in the western section of Cumberland.

Mr. Gordon Grant has been appointed chief engineer of the Dominion Highways Commission. He was formerly chief engineer of the National Transcontinental Railway. The salary attached to his new position is $6,000 per year.

Mr. L. C. Charlesworth, deputy minister of public works of Alberta, has been appointed Irrigation Counsel, a position recently created by the new Irrigation Act. Mr. Charlesworth will continue as deputy minister until such time as his new position will require all his time.

Mr. E. J. Harker, of Campbellton, N. B., has resigned from his position with the J. & D. A. Harquail Co., Ltd., with whom he has been connected for the past eleven years as architect and construction superintendent and has been appointed superintendent of construction of the Restigouche and Bay Chaleur Soldiers' Memorial Hospital at Cambelton, N. B.

Mr. Alex Wilson is now in business as consulting and supervising engineer at the Yorkshire Building, Montreal. He is a graduate of McGill University in electrical and mechanical engineering, and has held positions on the staffs of the Shawinigan Water and Power Co., Cedars Rapids Manufacturing & Power Co., and the Montreal Light, Heat & Power Co. He was identified with the construction of the Cedars Rapids hydro-electric plant, of which he was appointed superintendent on its completion. From 1916 to 1919 he served in France, and on his return was appointed assistant to Mr. R. M. Wilson, chief electrical engineer of the Montreal Light, Heat & Power Company.

Obituary

James Turner, a well-known contractor of Aylmer, Ont., died recently, aged seventy-nine years. Mr. Turner had resided in the town fifty-five years, and had erected a large number of the dwellings there.

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The Government's Effort to Kill the Publishing Industry in Canada

FURTHER information is to hand regarding the new postal rates on Canadian trade magazines, but it is safe to say no one anticipated such drastic suggestions as are contained in the draft amendment. Briefly the increase in postal rates is 300 per cent. for 1921 and 500 per cent. for 1922. This will be better understood when it is explained that the increase would be equivalent to a letter postal rate increase to 12 cents and 18 cents instead of the present 3 cent rate. Is it the Government's intention to kill the publishing industry in Canada?

Canadian magazines are already heavily handicapped in their competition with foreign publications. Most of Canada's young industries have received a measure of protection, but not so with the manufacturer of magazines. Not only do Canadian publishers pay duty on machinery and other essentials which are not purchased in Canada, but foreign publications enter Canada without any duty restrictions. Thus our country is being flooded with all sorts of propaganda literature, none the less effective because it is dressed in most attractive forms. As a result our people are being slowly and insidiously "Americanized"—without realizing it.

The manufacture and distribution of trade magazines is like the manufacture and distribution of any other product—and it is also unlike it. The likeness lies in the fact that along with shoes, plows, automobiles, or anything else, the "Made-in-Canada" article represents the employment of Canadian workmen, the circulation of Canadian money, the production of Canadian wealth, and the dozen-and-one other little advantages so generally recognized. The unlikeness, however, lies in the fact that a Canadian magazine teaches Canadianism—loyalty and pride in our own Canada—while the U. S. magazine, naturally and rightly, preaches—morning, noon and night—the Stars and Stripes. Even our Canadian publications—some of them—seem to forget at times, that the big men and the worthy deeds do not all "happen" outside our own borders—so great is that insidious influence exercised by the foreign press.

It is safe to say that Canadian publishers are as ready to carry their share of the heavy load of taxation, imposed by the European war, as any other industry. They have every reason to expect fair treatment, however, and working conditions that will enable them to perform their proper and natural functions. If Canadian trade magazines are essential in the making of a Canadian nation—and we know they are—then the carrying out of such suggestions as are contained in the amendments to the Postal Act would merely retard progress and play us into the hands of other countries who, naturally, would prefer to see us merely an "adjunct."

Heavily Capitalized Company to Enter Hydraulic Machinery Field

DETAILS of a new Canadian $10,000,000 company which will manufacture paper making machinery, turbo equipment and heavy hydraulic and hydro-electric equipment, are contained in a circular letter now being sent out by the Dominion Bridge Company to its shareholders.

After alluding to the report made to shareholders at the last annual meeting, concerning the incorporation of "The Dominion Engineering & Machinery Company, Limited," with a capital of $2,500,000, all owned by the bridge company, announcement is made that the directors of Dominion Bridge have been in negotiation with several important power companies which must soon make large additions to their hydraulic machinery.

In consequence of negotiations, a new company to be known as the "Dominion Engineering Works, Limited," is being incorporated with an authorized capital of $5,000,000 of 8 per cent. cumulative redeemable preferred shares and $5,000,000 of common shares, of which $4,000,000 of each class is now to be issued.

It is proposed that the Dominion Engineering & Machinery, Ltd., will sell its undertaking, receiving in payment therefor a majority of both preferred and common stocks now to be issued of the Dominion Engineering Works, Ltd., which will give the company a stock-controlling interest therein. The balance of the $4,000,000 preferred and the $4,000,000 common will be issued on such terms as will provide the company with sufficient working capital for its requirements and to cover the cost of installation of such additional plant and machinery as may be necessary for the extended operations of the company.

The new company will agree with William Cramp and Sons' Ship and Engine Building Company for the exclusive use of its water wheels and other hydraulic machinery. The William Cramp Co. has constructed most of the large water wheels in Canada and the British Empire, aggregating 658,000 h.p., including 101,000 h.p. for the Montreal Light, Heat and Power; 137,000 h.p. for the Shawinigan Water and Power; and 120,000 h.p. for the Laurentide Company.

The following gentlemen have consented to join the board of the new company:

Sir Herbert Holt, president Montreal Light, Heat and Power Co.; George Cahoon, Jr., president Laurentide Co.; Julian C. Smith, general manager and chief engineer, Shawinigan Water and Power Co.; Howard Murray, vice-president Aldred and Co.; H. Birchard Taylor, vice-president William Cramp and Sons.

The Relation of Safety to Engineering Efficiency

By L. A. DeBlois*

SURELY the heart of an engineer is in the same place as other men's hearts and responds to the same appeals, and if it has not yet responded to the call of accident prevention it is because the engineer is not in full possession of the facts.

I realize that engineers cannot lay aside the practice of their profession and go forth to a crusade of of safety. We must put them in full possession of the actual facts, beyond all chance of doubt, and then bring them to the realization that "safety is an essential element in all engineering work" and that this element can be supplied only by engineers.

The really useful years of life for either sex lie between the ages of 19 and 60. While the average age of those killed by accident is 37 and their normal life expectancy 30 years, if we select only those killed by accident between the ages of 19 and 60 we find that their untimely deaths in one year robbed the country of 715,000 years of useful life. If a year of useful life were worth only $100 the annual loss to the country would be over seventy million.

While the foregoing may interest students of efficiency in the larger sense, as engineers we are more interested in the application of accident prevention to industry and its bearing on engineering efficiency.

Let us for the moment assume that I have been called upon to prove that safety and mechanical efficiency go hand-in-hand. If this is true all true improvements in mechanical efficiency should bring commensurate improvements in safety—provided the standard of comparison is the same. Mechanical efficiency is the ratio of actual mechanical output to theoretical capacity for output—in other words, the basis is production. On the other hand, the basis of both accident frequency and severity is man-hours—that is, exposure. We know that if all other hazards remain the same and exposure is reduced, accident frequency and severity must necessarily be reduced. But improved machinery and so-called "labor-saving devices" introduce more mechanical power or higher powers, higher cutting speeds, etc., and while greatly reducing the exposure, subject the operatives to greater risks. Obviously, comparison of accident experience in such cases should not be on the basis of so many cases or so many days lost per 1,000 employees, but on unit of production. Such figures are not readily available but we can fall back upon an argument based on generalities.

Bigger Output From Mechanical Equipment

All over the country from year to year there has been a steady increase in production per employee and of late perhaps a very marked increase, stimulated by high labor costs and labor shortage. It would be possible to name hundreds of new mechanical devices or improved mechanical devices that have contributed to this—the electric crane, the airbrake, elevating, conveying and handling machinery, the electric motor, the gasoline engine, the storage battery, the compressed air tool, the high-speed machine tool, are all examples. Many of these we know by experience to be more dangerous devices than the appliances they replaced, but when we think of them as dangerous do we not reckon this danger on the basis of exposure, not on production? We say the electric crane, for instance, is more dangerous to its operative than was the chain-hoist, but do we stop to think that in a given space of time its mechanical accomplishment is many times greater?

Furthermore—and this is the real point I wish to make—in industrial undertakings where proper safety engineering and supervision has permitted a commensurate safe-guarding of these improved appliances—experience extending over a number of years has indicated that accident severity based on exposure has been from year to year reduced in spite of the introduction of more hazardous machinery. As output in relation to exposure has undoubtedly increased, we know that if the figures were available we would find that accidents in relation to output must have decreased in some cases to a remarkable extent. Surely here is something that leads us to the assumption—if not proof—that engineering efficiency and safety have a close relationship.

I sometimes wonder if there are not many engineers who fancy that the application of engineering science to accident prevention extends only to guarding belts, pulleys and gears and putting railings around high places.

The field of mechanical guarding is by no means narrow; gears, belts, pulleys and shafting as a rule present but few complicated problems, but when we undertake the guarding of the point of application of power to the material under process, the mechanical feeding and removal of material from continuous processes, the safe handling of substances of inherent danger, such as strong acids and caustics, hot substances and explosives, we impinge on a field worthy of any engineer.

It is true that accident analysis on the basis of accident frequency has led to the general conviction that three-quarters of all accidents are preventable by better supervision and education of the employee or foreman but analysis on the basis of severity tells a somewhat different story. Moreover after supervision and education are carried to a certain point, further reduction must be made through introducing safer processes or extending the scope of engineering revision.

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*Vice-chairman, Engineering Section, National Safety Council. Abstract of address delivered before the Spring Conference of the Engineering Section, N. S. C.

No. 25

Canada's Engineers—Olivier Lefebvre

Mr. Olivier Lefebvre, the chief engineer of the Quebec Streams Commission, is an authority on the subject of the construction of storage dams and the flow regulation of rivers. He is the author of papers on these matters, and in this connection has contributed to the columns of the "Contract Record."

Mr. Lefebvre was born at St. Hugues, County of Bagot, Province of Quebec, in 1879. He graduated from the scientific course at Mount St. Louis College in 1898, and took up training in engineering at the "Ecole Polytechnique," Laval University, Montreal, graduating with honors in 1902.

For three years Mr. Lefebvre was engaged in the cement testing laboratory of the Public Works Department, Ottawa, in charge of the chemical department. From 1905 to 1912 he was assistant engineer to the District Engineer, Public Works Department, Ottawa, and in that position had to undertake numerous river surveys and prepare plans for and supervise the construction of wharves. He also supervised the construction of the bridge piers at Chapeau, on the Ottawa River, and part of the construction of the Latchford dam. In the summer of 1912 he made a complete survey of Burrard Inlet and of False Creek at Vancouver, B. C., for the Public Works Department.

In February, 1913, Mr. Lefebvre was appointed chief engineer of the Quebec Streams Commission, Montreal, and has directed the work for this Board. This has included the design and construction of the following works: The Gouin Storage dam, for the flow regulation of the St. Maurice River; the dam at the outlet of Lake St. Francois, for the flow regulation of the St. Francois River near Disraeli, Que,. Lake Brule dam on the St. Anne River; and numerous reports on different rivers of the Province of Quebec.

Mr. Lefebvre is an associate member of the Engineering Institute of Canada; member of the American Society for Testing Materials; member of the Administrative Board of the "Ecole Polytechnique," Montreal; and a life member of the National Amateur Athletic Association.

Mr. Olivier Lefebvre

By this I do not desire to belittle the importance of supervision and education—I consider them indispensable, but I have come of late to the conclusion that as accident prevention progresses in any plant or corporation the importance of engineering revision constantly increases. This means an increasing need for safety men who are engineers and engineers who recognize accident prevention as essential to modern engineering.

In railroad work, no one will doubt that safety engineering is of utmost importance; mining is recognized as the industry of highest fatality rate; metallurgical engineering is also fraught with the occurrence of severe hazards and one has only to look to the iron and steel industry for examples of what has been accomplished in accident prevention. As for electrical and mechanical engineering, the forces dealt with are so numerous—so capable of destructive violence—and their application to industry so complex, that I can hardly conceive of any engineer failing to recognize that safety must enter as an important consideration. And so, the more thought I give to this matter of the relation of safety to the practice of engineering, the more I become convinced in my own mind that the only branch of engineering to which safety or accident prevention does not apply, and apply in a very vital way, is some branch—if you can name it—which does not have for its purpose the service of mankind.

Provincial Ministers at Roads Convention

SIR JAMES AIKINS, K.B., Lieutenant-Governor of the Province of Manitoba, has signified that he will formally open the Seventh Canadian Good Roads Convention, at Winnipeg, on Tuesday, June 1, and will give an address on the value of improved highways as an aid to the progress of the Dominion. He will be followed by the Hon. T. C. Norris, Premier of Manitoba, by the Hon. E. C. Drury, Premier of Ontario, the Hon. W. M. Martin, K.C., Premier of Saskatchewan, the Hon. Charles Stewart, Premier of Alberta, while Sir Lomer Gouin, Premier of Quebec, will also be present if he is back from his European trip in time to keep the engagement. If not, his place will be taken by the Hon. J. A. Tessier, Minister of Roads.

Among the other speakers at the opening session are the Hon. G. A. Grierson, Minister of Public Works, Manitoba; Hon. F. C. Biggs, Minister of Public Works, Ontario; Hon. W. G. Mitchell, Provincial Treasurer, Quebec; the Hon. J. H. King, M.D., Minister of Public Works, British Columbia; the Hon. S. J. Latta, Minister of Highways, Saskatchewan; Hon. J. P. Veniot, Minister of Public Works, New Brunswick; Premier G. H. Murray of Nova Scotia, Premier H. J. Bell, K.C., of Prince Edward Island, Mayor Chas. F. Gray, of Winnipeg; L. B. Howland, president of the Canadian Automobile Association, and B. Michaud, deputy-minister of roads, Quebec.

Preparations are Made for the Most Successful Convention of the Canadian Good Roads Association Ever Held

On Tuesday, Wednesday and Thursday of Next Week, Delegates Will Assemble at Royal Alexandra Hotel, Winnipeg, for Seventh Convention and Exhibition

ON Tuesday of next week the Seventh Good Roads Convention and Exhibition will open its proceedings at the Royal Alexandra Hotel, Winnipeg, under the joint auspices of the Canadian Good Roads Association and the Manitoba Good Roads Association. Special arrangements have been made at the hotel for the accommodation of the meeting and the show in connection therewith. A very large number of delegates have already signified their intention of being present and every effort is being made to see that they are kept interested and entertained. The executive and various committees of the Canadian Good Roads Association are taking great pains to make this, the seventh convention, the most successful ever held.

The West Enthusiastic on Good Roads

It is exceptionally significant that this year's convention takes place in a western city. Heretofore this annual meeting has been confined to Ontario or Quebec. Now, however, the good roads movement knows no bounds and the West is just as enthusiastic on improved highways as the more settled and populous provinces in the eastern part of the Dominion. True, of course, Ontario and Quebec are bearing the lion's share of good roads expenditures, but the density of population in these provinces demands a much heavier outlay than in districts of more scattered population. The provinces west of the Great Lakes have not been marking time, however. Large appropriations have been made by their respective governments and especially by that of Manitoba, where the good roads movement has been especially active in the past few years. Fortunately the public has realized the advantages of good roads and bridges and the government has followed public sentiment by inaugurating legislation that has meant and will continue to mean an increasing mileage of highway each year. In view, then, of the intense interest that is being displayed in Manitoba in connection with the movement for good roads, it is especially appropriate that the leading city of the West should be chosen as the scene of the 1920 convention of the Canadian Good Roads Association.

Wide Variety of Topics

The tentative official program shows a wide variety of subjects to be brought before the delegates for discussion. All types of road, and especially those types which the West will be called upon to employ, are to form topics for discussion, and prominent road engineers have been chosen to read papers dealing with them. The economic side of road building has not been neglected, for we note on the program papers on such subjects as "Suggestions for Financing a Highway System," "Organization of Highways Departments to Obtain and Maintain High Standards of Efficiency," "The Value of the Local Association to the Nation-Wide Highways Movement," "The Importance of Keeping a Traffic Census," and so on. A number of engineers from the United States have also been invited to participate in the proceedings. This

S. L. Squire, President of Canadian Good Roads Association

A. W. Campbell, Dominion Commissioner of Highways, and Honorary President of Canadian Good Roads Association

G. A. McNamee, Secretary-treasurer, Canadian Good Roads Association

Some of the Executive Officials of the Canadian Good Roads Association

U. H. Dandurand, a Past-President and Member of Advisory Committee

A. F. Macallum, First Vice-President

B. Michaud, Past-President and Member of Advisory Committee

Capt. J. A. Duchastel de Montrouge, Past-President and Director

Hon. S. J. Latta, Minister of Highways, Saskatchewan, a Director of the Canadian Good Roads Association

William Findlay, Director of the Association

is in accord with former procedure and serves to give the Canadian convention an international aspect and a prominence that marks it as one of the most important conferences of its kind on the continent.

Exhibition of Equipment

A number of special features have been arranged for in connection with the convention. At the usual exhibition there will be shown a varied and interesting exhibition of road materials, models, photographs, etc., while an exhibit of heavy machinery will be located at the rear of the hotel. Practical demonstrations of road making have been arranged for, two sections of road being built by the Canada Iron Company, Kelly-Powell, Limited, and The United Grain Growers, Limited. These firms will construct sections of gravel or earth roads, supplying all the necessary men and machinery. Apart from the practical demonstrations the delegates will be shown moving picture films taken by the Department of Public Highways of Ontario. These films, which have been enthusiastically received in the past, portray the construction of waterbound macadam, earth, cement-concrete, asphaltic-concrete, tar macadam and gravel roads.

During the session a special conference of local and provincial good roads associations will be held on Thursday afternoon, June 3, under the chairmanship of Mr. William Findlay, business manager of the "Globe," Toronto, and a very enthusiastic "good roader." An interprovincial conference of highway officials will also be held on Wednesday afternoon, June 2nd.

The program, as given in an official announcement, is printed herewith:

Tuesday, June 1st

9.00 a.m.—

Registration of delegates and visitors at convention headquarters. Registration continuing throughout the convention. Tickets for the annual dinner will be furnished by the registration clerk.

9.30 a.m.—

Appointment of nomination and resolution committees.

First Session

10.30 a.m.—

Congress called to order by the President, Mr. S. L. Squire.

Among those present will be: Hon. Sir James Aikins, K.B., Lieutenant-Governor, Province of Manitoba.

Hon. T. C. Norris, Premier, Province of Manitoba.

Hon. Geo. A. Grierson, Minister of Public Works, Manitoba.

Hon. E. C. Drury, Premier, Province of Ontario.

Hon. F. C. Biggs, Minister of Public Works, Ontario.

Hon. Sir Lomer Gouin, K. C. M. G., Premier, Quebec.

Hon. J. A. Tessier, Minister of Roads, Quebec.

Hon. W. G. Mitchell, Provincial Treasurer, Province of Quebec.

Hon. James H. King, M.D. Minister of Public Works, British Columbia.

Hon. W. M. Martin, K. C., Premier, Saskatchewan.

Hon. S.J. Latta, Minister of Highways, Saskatchewan.

Hon. Charles Stewart, Prime Minister, Alberta.

Hon. P. J. Veniot, Minister of Public Works, New Brunswick.

Hon. G. H. Murray, Premier, Nova Scotia.

Hon. J. H. Bell, K.C., Premier, Prince Edward Island.

B. Michaud, Deputy Minister of Roads. Province of Quebec.

Mayor Chas. F. Gray, City of Winnipeg.

L. B. Howland, President Canadian Automobile Association.

Noon—

Particulars of the demonstration of road work, by the Canada Ingot Iron Co., Kelly-Powell Limited, and the United Grain Growers Ltd. will be announced from the chair.

Second Session

2.30 p.m.—

Presiding officer, S. L. Squire.

Address: "Federal Aid," C. A. Magrath, Chairman, Highways Commission, Dominion Government, Ottawa, and E. O. Hathaway, District Engineer, U. S. Bureau of Public Roads, Minneapolis, Minn.

Paper: "Gravel Roads," by B. M. Hill, Provincial Highway Engineer, Province of New Brunswick.

Paper: "Surface and Subsoil Drainage," by A. Fraser, Highways Department, Province of Quebec.

Paper: "Road Machinery," by Arthur H. Blanchard, Professor Highway Engineering, University of Michigan, Ann Arbor, Mich.

7.30 p.m.—Annual dinner and entertainment (informal) Royal Alexandra Hotel.

Wednesday, June 2nd.

Third Session

Presiding officer, T. P. Regan.

10.00 a.m.—

Address: "Roads as an Aid to Agriculture."

Paper, "Economical Methods of Transporting Road Materials," by A. P. Sandles, Secretary National Crushed Stone Association, Columbus, Ohio.

Paper, "How to Improve and Maintain Earth,

Provinces Will be Represented by Their Engineers and Ministers

B. M. Hill, Provincial Road Engineer, New Brunswick

Geo. Hogarth, Chief Engineer, Department of Public Highways, Ontario

Hon. P. J. Veniot, Minister of Public Works, New Brunswick

Three Good Road Enthusiasts Whose Spirit Will Dominate Winnipeg Meeting

Hon. J. A. Tessier, Minister of Roads, Province of Quebec

W. A. McLean, Deputy Minister of Highways, Ontario

Capt. L. E. Allen, President Ontario Good Roads Association

Clay and Sand Roads," by A. R. Hirst, States Highway Engineer, Madison, Wis.

Paper, "Broken Stone Roads," by Geo. Hogarth, C. E. Chief Engineer, Ontario Highways Department.

Noon.—Annual meeting, Canadian Automobile Association, at Royal Alexandra Hotel.

Fourth Session

2.30 p.m.—

Presiding Officer, Russel T. Kelley.

Address: "Suggestions for Financing a Provincial Highway System," by A. W. Campbell, Commissioner of Highways, Dominion Government, Ottawa.

Paper: "Bituminous Treatment of Sand Roads," by Col. W. D. Sohier, ex-chairman, Massachusetts Highway Commission, Boston, Mass.

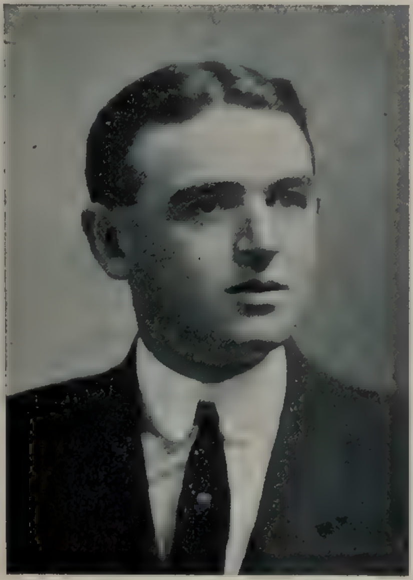
Paper: "Road Dragging and Maintenance Competition."

Paper: "Organization of Provincial Highways Departments to Obtain and Maintain High Standards of Efficiency," by A. E. Foreman, Chief Engineer Public Works Department, Province of British Columbia.

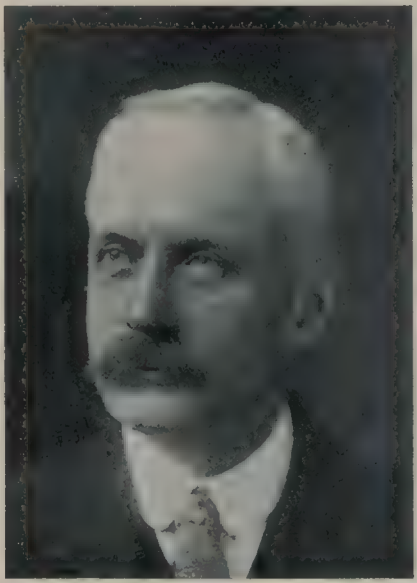
8.30 p.m.—Annual general meeting, Canadian Good

(Continued on page 491)

The Canadian Good Roads Congress is International in Scope—Three U.S. Visitors



A. R. Hirst, Chief Engineer, Wisconsin Highway Commission



Col. W. D. Sohier, ex-Chairman, Massachusetts Highway Commission

A. H. Blanchard, Professor of Highway Engineering, University of Michigan

Stone Quarries of Ontario Prepared to Cope With Demands of Highway Projects

Plants Being Improved to Increase Production—Stone Resources Well Distributed Throughout Provincial Highway Area

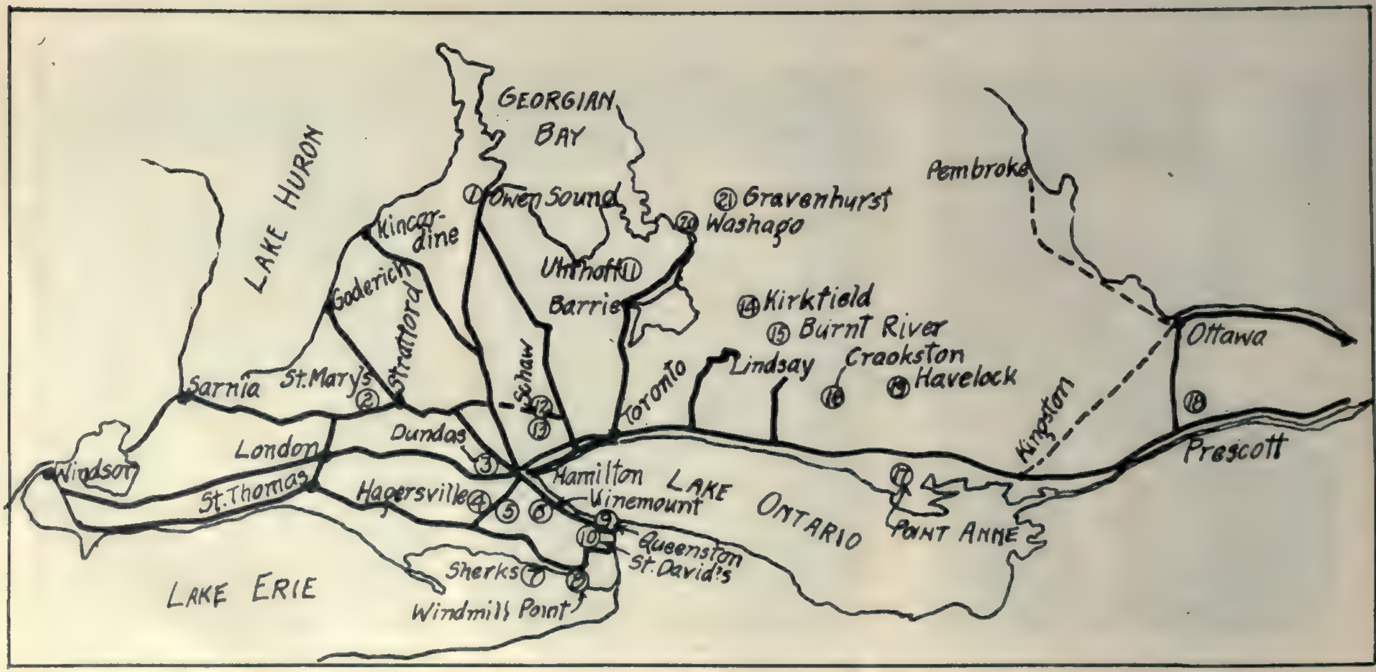
EIGHTEEN hundred and twenty-four miles is the extent of the provincial system of highways which, as announced by Hon. F. C. Biggs, Minister of Public Works and Highways of Ontario, are to be constructed largely by provincial funds and federal aid grants. The roads which have been selected for this scheme cover the majority of the older portion of the province, forming a network linking together all main market centres. As the highways are the main interurban and trans-county roads, they will carry a heavy volume of traffic and their construction must needs be of a high order. The Minister of Public Works and Highways has intimated that macadam will be employed very extensively and that only a few of the roads, at the present time at any rate, will be made of a more permanent type.

The problem that confronts the builders of any road system is the supply of material in adequate amount and at an economical cost. When stone in any abundance is required for road surfacing, local quarries are desirable to avoid long rail or truck haul. The same applies to the Ontario provincial system. Many people have wondered where the stone for many of the roads is to come from. Some roads on the system are very lengthy and were local quarries not available the length of the haul would make the cost of the stone almost prohibitive. Investigation of the quarry resources of Ontario, however, indicates that the province is particularly fortunate in the distribution of its stone quarries. The accompanying map has been prepared to indicate the location of these quarries in relation to the provincial highways. It will be noted that large capacity quarries are distributed throughout the area covered by the provincial highways in a manner that will make the stone supply for these roads a fairly easy problem to handle. The following list gives the names and capacities of the quarries shown, the numbers corresponding with the numbers on the map.

Quarries in Ontario and Their Capacities in Tons per Day

1—Oliver Rogers Stone Co., Owen Sound	400
2—Thames Quarry Co., Ltd., St. Mary's	500
3—Canada Crushed Stone Corp., Dundas	3000
4—Hagersville Contracting Co., Hagersville	500
5—Hagersville Crushed Stone Co., Hagersville	500
6—Wentworth Quarry Co., Ltd., Vinemount	500
7—Empire Limestone Co., Sherkston	800
8—Standard Crushed stone Co., Windmill Point	400
9—Queenston Quarry Co., St. Davids	300
10—Standard Crushed Stone Co., St. Davids	300
11—Ontario Stone Corp., Uhthoff	400
12—John Maloney, Puslinch	300
13—Christie Henderson Co., Puslinch	200
14—Crushed Stone, Ltd., Kirkfield	1000
15—Britnell & Co., Ltd., Burnt River	400
16—Quinlan & Robertson, Crookston	300
17—Point Anne Quarries, Point Anne	2000
18—Prescott Quarries, Prescott	under construction
19—Ontario Rock Co., Havelock	
20—Washago Quarry Co., Washago	300
21—National Potash Co., Gravenhurst	500

The quarry owners realize the call that will be made upon them not only in connection with provincial roads, but also in connection with local systems undertaken by the counties and townships and they are preparing to cope with any demands that may be made upon them for supplies of material. Many of the quarries are increasing their capacities to a considerable degree, some as much as four-fold. Other plants, like



Location of stone quarries of Ontario in relation to proposed provincial highways. Numbers correspond to those in the text those of the Standard Crushed Stone Company and the Empire Limestone Company will run to full capacity this year after being idle for the past three years. Others, again, like the Canada Crushed Company, of Dundas, and the Queenston Quarry Company, at St. David's, have installed storage systems so that an adequate supply will always be on hand.

Such action on the part of quarry operators points to the fact that they are preparing to co-operate with municipal and provincial governments in the building of the greatest possible mileage of improved highway. Twelve thousand tons per day is stated to be the total capacity of the 21 plants in provincial highway area, so that it is seen that the quarries of the province of Ontario are quite capable of meeting any demand.

The list following indicates the preparations that are being made to increase production to take care of the new programs of road development.

Quarry	Location	Improvement
Britnell & Co.	Burnt River	Increased capacity from 150 to 300 tons per day
Crushed Stone, Ltd.	Kirkfield	Increased capacity from 500 to 1000 tons per day
Point Anne Quarries	Pt. Anne	Increased capacity from 650 to 2000 tons per day
Ontario Stone Corp.	Uhtoff	Increased capacity double
Thames Quarry Co.	St. Mary's	Increased capacity to 1000 tons & installed steam shovel
Hagersville Contracting Co.	Hagersville	Increased capacity & installed steam shovel
Hagersville Crushed Stone	Hagersville	Increased capacity & installed No. 8 crusher
Oliver-Rogers Stone Co.	Owen Sound	Increased capacity
Wentworth Quarry Co.	Vinemount	Increased capacity
Canada Crushed Stone Corp.	Dundas	Installed storage system 60,000 tons capacity
Queenston Quarry Co.	St. David's	Installed storage system 10,000 tons capacity
Crookston Quarries, Ltd.	Crookston	Building large modern plant
Standard Crushed Stone	Windmill Point	These plants have been idle for past three years but will run to capacity this year
Empire Limestone Co.	Sherkston	
John Maloney	Puslinch	
Christie-Henderson & Co.	Puslinch	
Ontario Rock Co.	Havelock	Increased capacity

Asphalt Fillers for Brick and Stone Pavements

Methods of Application and Specifications for Material—Joint Filling in Monolithic Construction

ASPHALT fillers are extensively used for filling joints in brick, stone block and portland cement concrete pavements. They are of three general types. The poured joint filler is a specially prepared asphalt which may be heated and poured or squeegeed into joints or cracks. The asphalt-grout filler is a mechanical mixture of asphalt cement and fine sand which while hot may be poured over the pavement surface and broomed or squeegeed into the joints. The prepared joint filler may consist either of specially prepared asphalt in the form of premoulded strips, which are inserted in the joints, or they may be premoulded mixtures of asphalt with such substances as limestone dust, silica, etc. Sometimes the filler strips are reinforced with fabric and sometimes they consist of one or more layers of fabric or felt saturated with asphalt. Premoulded expansion joints reinforced with metal are also manufactured. The merits of asphalt fillers and the purposes they serve are enumerated in a brochure recently issued by the Asphalt Association. Some excerpts follow:

Advantages of Asphalt Filler for Brick or Block Construction

The advantages resulting from the use of asphalt fillers as compared with a rigid type of filler have been so well demonstrated by service results that asphalt has become a standard of good construction in brick and stone block pavements. After years of experience with various types the National Paving Brick Manufacturers Association published an "Announcement" in the latter part of 1919 in which the following statement was made:

"The standard form of wearing surface construction recommended is 3 inch brick, ¾ inch sand cushion with the standard asphalt filler of the National Paving Brick Manufacturers Association in the joints."

One of the chief advantages of the asphalt filler is the fact that it does not produce a rigid monolithic pavement. Each brick or block is surrounded with an asphalt cushion which prevents the fractures so often occurring where rigid fillers are used, and materially reduces the noisy rumble of traffic. Full development of the cushioning effect of the underlying sand bed is also secured in a manner not possible with a rigid filler. Unlike a rigid filler, asphalt does not chip and crumble from the edges of the brick or block and spalling is thereby largely prevented. The entire pavement is waterproofed and as cracks cannot form water will not find entrance from the surface to the foundation and no damage from this source is possible.

In a paper presented at the 1919 Convention of the American Society for Municipal Improvements Mr. Clark R. Mandigo, consulting engineer, Western Paving Brick Manufacturers Association, very clearly enumerated the advantages of the asphalt filled pavement as follows:

"(1) The street or road may be opened for traffic as soon as the filler has been applied.

(2) Service cuts and openings are easily and simply repaired.

(3) It carries the minimum risk in construction, since serious defects do not result through careless workmanship, lax inspection, or ignorance—a real advantage in these days of inefficient labor.

(4) That steps in construction are simple, all materials being tested before being incorporated in the pavement and an opportunity given to correct any mistakes by the following step.

(5) The filler is easily manipulated, and not sub-

ject to damage by frost, rain or premature traffic.

(6) Noise is eliminated.

(7) It provides an ideal, non-skid, smooth riding surface for automobiles and gives a good grip for auto tires and horses on all grades.

(8) Expansion and contraction are properly and effectively cared for.

(9) The elastic filler cushions the brick and the foundation from shock and impact, reducing the thickness of base required and allowing slight readjustments between individual brick under traffic so that each brick remains solidly bedded in the sand cushion —there is no necessity for a sand-mortar cushion.

(10) The wearing surface, being semi-flexible, adjusts itself to slight changes in foundation conditions without damage, and to deflections in less rigid types of bases than concrete."

Asphalt Filler in Brick Pavement Construction

While with lug brick the asphalt filler may be hand-poured into the joints by means of narrow spout pouring cans, it is now customary to flood the entire surface of the pavement with melted asphalt and to squeegee it into the joints. For such method of application the following specification for filler has been adopted by both the National Paving Brick Manufacturers Association and The Asphalt Association.

Specifications for Asphalt Filler for Brick Pavements

(To Be Applied by the Squeegee Method)

General

The asphalt filler shall be homogeneous, free from water and shall not foam when heated to 200° C. (392° F.).

Physical and Chemical Properties

1. Flash point not less than 200° C. (392° F.).
2. Melting point (ring and ball) 65° C. (149° F.) to 100° C. (212° F.).
3. Penetration at 25° C. (77° F.), 100g., 5 sec.....*.... to ....*....

Penetration at 0° C. (32° F.), 200g., 1 min., not less than 10.

4. Ductility at 25° C. (77° F.), not less than 2.
5. Loss at 163° C. (325° F.), 5 hrs., not more than 3%.
6. Total bitumen (soluble in carbon disulphide), not less than 99%.
7. Per cent. of total bitumen soluble in carbon tetrachloride, not less than 99%.

* Note. The exact penetration limits should be inserted by the engineer with a 10-point limit. It is suggested that for low temperature conditions a penetration of from 40 to 50 be specified and for high temperature conditions a penetration of from 30 to 40 be specified.

Sample

A one-pound sample of the asphalt filler that the contractor proposes to use in his work together with a statement as to its source and character must be handed in with his bid. No asphalt filler other than that specified in his bid shall be used by any contractor except with the written consent of the engineer and provided that the filler used shall comply in all respects with these specifications.

Methods of Testing

1. Flash Point (open cup), U. S. Dept. of Agriculture Bulletin 314, P. 17.
2. Melting Point, A. S. T. M. Standard method D-36-19.
3. Penetration, A. S. T. M. Standard Test D-5-16.
4. Ductility, Trans. A. S. C. E., Vol. LXXXII, 1918, P. 1460.
5. Volatilization Test, U. S. Dept. of Agriculture Bulletin 314, P. 19 using 50 gram sample.
6. Total bitumen, U. S. Dept. of Agriculture Bulletin 314, P. 25.
7. Bitumen Soluble in carbon tetrachloride, U. S. Dept. of Agriculture Bulletin 314, P. 30.

The asphalt filler is melted in kettles at the site of the work and brought to a temperature of from 300° F. to 400° F. The latter temperature should not be exceeded for danger of injuring the filler. It is then transferred to cans or buckets and flooded over the surface of the pavement. While still hot it is moved back and forth with squeegees (which may be heated) until the joints are filled. From 1½ to 2 gallons of filler per square yard will ordinarily be required. The pavement is finished off with a cover of sand which combines with the excess asphalt to produce a thin mat upon the surface, thus keeping the joints crowded full. In summarizing the advantages of asphalt filler Mr. Mandigo, in an article published in the July 1919 number of Municipal and County Engineering, states as follows:

"It was expected at first, that brick pavements with asphalt filler would require some maintenance of the joints. Pavements 8 to 10 years old under various classes of city traffic, however, look better than when first laid and the joints, as a rule, remain full. In fact this type of brick pavement has shown even less expense for maintenance than cement grouted brick, since there are no cracks formed and no bricks chipped or sheared from expansion stains."

Asphalt Filler in Stone Block Pavement Construction

For stone block pavements an asphalt grout filler is more commonly used than the poured joint filler, and is particularly well adapted to this type of construction because of the greater width of joints.

Sand for the asphalt grout filler should consist of clean hard quartz grains, all of which will pass a 10 mesh sieve. At least 80 per cent. should preferably pass a 20 mesh sieve, but not more than 10 per cent. should pass the 100 mesh.

The asphalt most commonly used for this type of filler is a paving cement of suitable consistency, and should meet the following specifications which have been adopted by The Asphalt Association after co-operation with the Committee on Stone Block Pavements of the American Society for Municipal Improvements and the Granite Paving Block Manufacturers' Association.

Specifications for Asphalt Filler for Stone Block Pavements

(To be Applied as Grout When Mixed with Sand)

General

The asphalt filler shall be homogeneous, free from water and shall not foam when heated to 175° C. (347° F.). It shall meet the following requirements:

Physical and Chemical Properties

1. Specific Gravity 25°/25° C. (77°/77° F.), not less than 1.000.
2. Flash Point, not less than 175° C. (347° F.).
3. Penetration at 25° C. (77° F.), 100g., 5 sec.,.....*.... to ....*....
4. Ductility at 25° C. (77° F.), not less than 30.
5. Loss at 163° C. (325° F.), 5 hours, not more than 3%.

   Penetration of residue at 25° C. (77° F.) 100g., 5 5 sec. as per cent. of original penetration, not less than 50%.

6. Per cent. of total bitumen soluble in carbon tetrachloride, not less than 99%.

* Note. The exact penetration limits should be inserted by the engineer with a 20-point limit. It is suggested that for low temperature conditions a penetration of from 70 to 100 be specified and for high temperature conditions a penetration of from 50 to 70 be specified.

Sample

A one-pound sample of the asphalt filler that the contractor proposes to use in his work, together with a statement as to its source and character must be handed in with his bid. No asphalt filler other than that specified in his bid shall be used by any contractor except with the written consent of the engineer and provided that the filler used shall comply in all respects with these specifications.

Methods of Testing

Tests of the physical and chemical characteristics of the asphalt filler shall be made in accordance with the following methods:

1. Specific Gravity, U. S. Dept. of Agriculture Bulletin 314, P. 5.

2. Flash Point (open cup), U. S. Dept. of Agriculture Bulletin 314, P. 17.
3. Penetration, A. S. T. M. Standard Test D-5-16.
4. Ductility, Trans. A. S. C. E., Vol. LXXXII, 1918, P. 1460.
5. Volatilization Test, U. S. Dept. of Agriculture Bulletin 314, P. 19 using 50 gram sample.
6. Bitumen soluble in carbon tetrachloride, U. S. Dept. of Agriculture Bulletin 314, P. 30.

Preparation of Mastic

The asphalt grout or mastic is prepared by mixing the melted asphalt filler with as much of the hot dry sand as it will carry without making a mixture that is too stiff to flow into the joints. In no case, however, should the volume of sand exceed that of the asphalt and in general, volume proportions approaching 3 parts of asphalt to 2 parts of sand will be found most satisfactory. Both asphalt and sand should be heated to between 300° F. and 400° F. but the latter temperature should never be exceeded for fear of injuring the asphalt. Portable kettles and sand heaters are used for this purpose and the mixture is usually made in large steel wheel barrows or concrete carrier push carts. A measured quantity of the hot asphalt should first be run into the mixing receptacle and a measured quantity of hot sand then added. The contents should be thoroughly mixed with a rake or hoe and immediately flooded over the surface and pushed or squeegeed into the joints. Once the proper proportions are fixed they should be rigidly adhered to throughout the work. Too often the proportioning and mixing are carelessly performed and this cannot help but produce lack of uniformity in results. The development and use of a small portable mixer for such work is an improvement much desired.

It is very important that the asphalt grout be worked into the joints as fast as possible after the mixture has been made. When first flooded over the surface it should flow readily but in contact with cold block it will soon stiffen to such an extent that it cannot be worked. A second application is almost always required over a considerable proportion of the area flooded by each batch in order to fill the joints flush with the surface. Bringing the joints flush by the addition of sand or other material is very bad practice and will ultimately result in a surface which is rough and cobbly in places.

The filler gang should closely follow the rammers and all joints of rammed pavement should be filled before the end of the day's work. The surfaces of the block should be thoroughly clean and dry and the work should preferably be conducted in warm weather. In case rain stops the filler gang before its work is finished the unfilled joints should be protected by tarpaulins or other means so as to keep out water. At completion of the work a thin mat of the grout should adhere firmly to the surface of the pavement and make it smooth and uniform. If the blocks are very cold or wet when the filler is applied this mat will not adhere properly and will soon begin to scale off under heavy traffic. Under proper conditions of application it will remain for a long period, and when it finally disappears the rough points on the heads of the blocks will have worn away so that a smooth, even, well-filled surface is exposed.

Approximately 2.5 gallons of asphalt is required for filling each square yard of standard 5 inch granite block pavement, this amount being, of course, subject to variation with the width of joints. A light sanding of the surface will usually be required to prevent the mat from adhering to the wheels of vehicles. Care should be taken that the mat does not average more than ¼ inch in thickness on the heads of the blocks and precaution should be taken to prevent slop-over of the asphalt as it is being drawn from the kettle and mixed with the sand, in order to prevent the formation of thick fat spots on the surface of the pavement.

Joint Filling in Monolithic Construction

In the monolithic types of pavement expansion and contraction are usually provided for by the construction of transverse or longitudinal joints which are filled with asphaltic compounds. Each joint in an asphalt-filled brick or block pavement serves this purpose and in an otherwise monolithic type two or more courses of asphalt-filled brick are sometimes inserted in the pavement in place of the usual single joint which is filled either with a poured asphalt filler or a prepared joint filler.

Expansion joint spaces are ordinarily formed by means of strips of wood or metal which are inserted during construction and later withdrawn, thus leaving empty slots. Care should be taken that these slots are kept perfectly clean until the filler is poured in. as accumulations of dirt, sand or pebbles in the slots will not only interfere with properly filling the joints but may pack so as to interfere with expansion of the pavement. The hot asphalt filler should be poured into the joints by means of pouring cans fitted with narrow spouts which may be inserted in the top of the joint spaces. The filler is then allowed to flow into the joints until a little more than flush with the surrounding surface. A slight surplus is necessary in order to allow for shrinkage upon cooling. The finished joint should, however, be brought practically flush with the pavement and a hot smoothing iron may be used for this purpose in case the joint is overfilled. The same precautions relative to heating the filler should be taken as described under brick pavements.

Prepared joint fillers which are manufactured in strips of the thickness desired for the width of the joint are placed during construction of the pavement and if they project above the surface are eventually flattened out with a hot smoothing iron which not only brings them flush with the surrounding pavement but seals the top of the joint and makes it waterproof. If the filler projects more than ⅜ of an inch above the surface it should be trimmed. A hot shovel, to the bottom of which metal cleats have been riveted, is sometimes used for trimming joints.

The members of the Builders' Exchange of Cleveland, Ohio, and their families have planned an excursion to the Royal Muskoka Hotel, Lake Rosseau, Ont., from July 1 to 7. This organization arranges an outing of this character annually and Canada has been chosen as the scene of this summer's trip. The builders will leave Cleveland on the night of Thursday, July 1, by steamer, arriving in Buffalo the following morning and leaving that city immediately by rail for Muskoka Wharf, at the end of the Muskoka Lakes. Connection will be made there by steamer for the Royal Muskoka Hotel, the party arriving at the hotel in time for dinner on Friday, July 2. Saturday, Sunday, Monday and part of Tuesday will be spent at the hotel and return will be made in time to get the Cleveland boat from Buffalo on the evening of Tuesday, July 6. The details of the excursion are now being arranged under the direction of J. F. Maline, chairman of the Entertainment Committee of the Exchange.

A WORD OF CAUTION!

Perhaps no more significant incident could be offered to herald a pause in the steadily upward trend of prices than the announcement of the big Wanamaker store in Philadelphia that all prices would be cut to make an average reduction of 20 per cent. Further it is stated that the store policy will be to make new purchases only on a basis which will permit of this reduction being made. The lead of Wanamaker will have a wide influence. Whether any such action will be taken by the big stores in Canada is a point upon which no information is available, but it is reported that one of the mammoth retail concerns has had the quietest period for the spring season of the past ten years. Certainly an effort is being made to make prices more attractive, to judge by the advertising.

In Business and Trade Circles

It appears that clothing and apparel lines are being hardest hit. Whether this is the result of very unfavorable weather or whether the public disapproval of high prices, as evidenced in the overall campaign, is having its effect upon consumption cannot be definitely answered, but perhaps it would be best to say that it is the effect of the combined influences. While there had been no tendency to produce in excess of prospective demand there is no doubt but that such unfavorable weather as we have experienced has tended to bring about an accumulation. Then it is reported that a lot of Japanese silks were dumped into Canada with some effect upon the market for dress goods and linings, and in the clothing trade there was an effort made prior to the last settlement with labor to get considerable stocks ahead to provide an available surplus in the event of a tie-up.

Altogether the situation in the clothing and apparel trades indicates that high prices are having their effect. It takes but little slackening of demand to result in over-production. In the hat trade, for instance, these tendencies are strongly in evidence. With practically no spring weather until this week the habit of getting the "old one" cleaned and blocked has increased, with the result that the average man is merely passing from winter to summer so far as his headgear is concerned.

In other lines there do not appear to be the same indications of a reaction. True, speculation has been very largely discontinued under the double influence of curtailment of loans by the banks and the growing belief that it is not a time to stock up. In foodstuffs there is no indication of weakening prices nor does it seem likely that there will be any marked change until there is some marked increase in supply, for it does not appear likely that consumption can be further reduced to any marked extent.

In the steel and other metal trades the situation is firm. Here the shortage of material is still maintaining prices, but there is no tendency to buy stock at present quotations. Steel is being bought for quick consumption on a premium basis and few chances are being taken. In hardware lines there appears to be a fair spring movement and prices are firm to strong.

The Financial Situation

The general outlook is for higher rates for money. Capital is being demanded in many directions and interest rates are strengthening. The further decline in Victory bond quotations in a few weeks is an indication of the trend of money values. Bond dealers foresee difficulties in securing the funds desired for provincial and municipal purposes at anything like satisfactory rates. Should the Dominion Government desire to float a loan this fall it is hard to see how this can be done except at rates that will discount previous issues. However, it is more than possible that there is a connection between the Government's plans and the course being taken by the banks in putting on the brakes.

Higher rates on mortgage loans appear to be inevitable under such conditions. The general situation in the money market will be reflected here. This promises to add further uncertainty to the building situation. There is little to encourage the speculative builder and much to discourage him. Building will, therefore, be largely confined to those who are making homes for themselves. The solution of the housing problem seems as far off as ever.

The outlook for prices for building materials is very unsettled. Dealers and manufacturers say that they can see no reduction in costs and, therefore, nothing to warrant lower prices. On the other hand, it is understood that the policy of the banks may mean that some dealers will have to dispose of at least a portion of their stocks and this may force supplies on the market.

Altogether it is a very unsettled situation and one in which the wise business man and investor will watch developments closely. And in sounding this word of caution we would like it to be distinct from pessimism. The position which Canada occupies to-day in world's relations leaves no room for pessimism. The world is waiting for our goods. If we cannot produce and market at prices to compete with other nations under present conditions then a readjustment is inevitable—and the sooner the better.

Bridge Construction in Province of Manitoba

The Building of Bridges of a More Permanent Material Than Timber is the Policy of Manitoba Government—Reinforced Concrete is Superseding Other Materials—Examples of Typical Designs of Bridges with Unit Prices of Construction

UNDER "The Good Roads Act" provincial assistance is given to municipalities towards the cost of constructing culverts and bridges to the extent of one-third the cost of wooden bridges costing $500 or over and one-half the cost of more permanent structures such as steel or concrete, costing $200 or over. The policy has been to advise on the construction of the more permanent structures instead of timber structures, with the result that up to the end of 1919, 271 reinforced concrete structures, 31 steel on masonry and 74 timber bridges had been built.

Under "The Good Roads Act" all work is let by tender and contract to the lowest responsible bidder. The structures are designed by the bridge department of the good roads board, and the work carried out under the supervision of the engineers of the department. Standard plans have been prepared as far as possible, but it is generally only in the smaller structures that these can be used economically. It is the purpose of this article to briefly describe some of the types of culverts which are being built and give a general idea of the unit prices under which they have been constructed. As a general rule, tenders are asked for and contracts let on a unit price basis. An example of typical designs will be given, costs of a certain bridge of that type and conditions surrounding its construction, of timber pile bridges, howe truss on timber, howe truss on masonry, short steel spans, steel trusses on masonry, concrete culverts, slab and

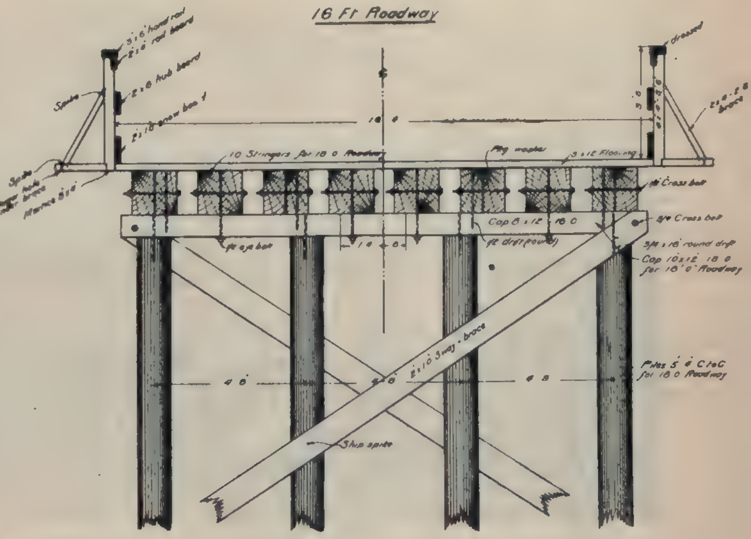


Fig. 1—Section of a standard pile bridge, now seldom used in Manitoba by the Good Roads Board

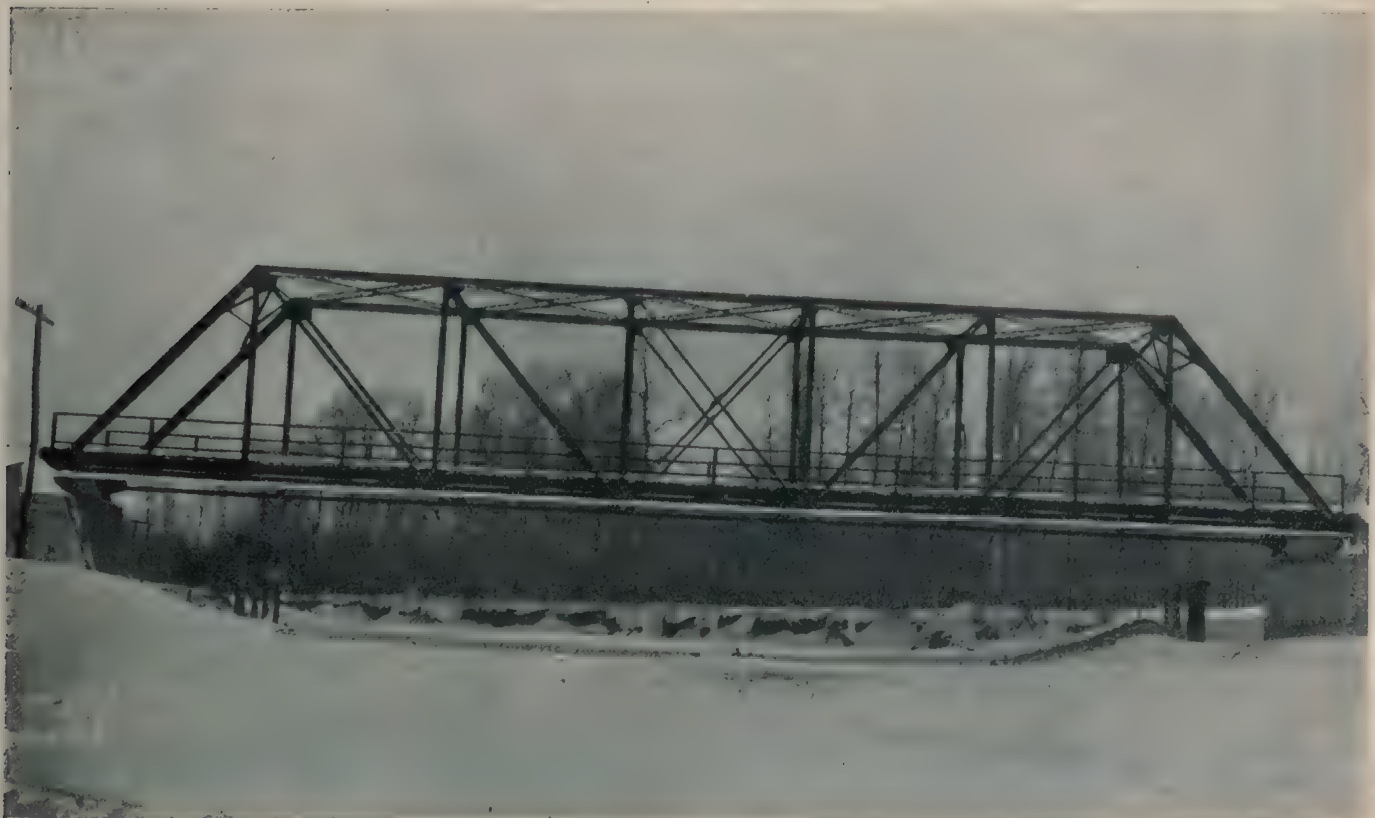


Fig. 2—Steel bridge, 126 feet span, built in Swan River Municipality, Manitoba

girder short spans, barrel arches, open spandrel arches, half-through arches and bow string spans.

Pile Bridges

This was the common type of bridge in Manitoba when the first cost was the main factor, in the days of light traffic and comparatively low cost of timber, piles and labor. Relatively few of this type are now being built in the organized portion of the province, because, while still cheapest in first cost, they are rarely the most economical type to build. Figure (1) shows a section of a standard pile bridge.

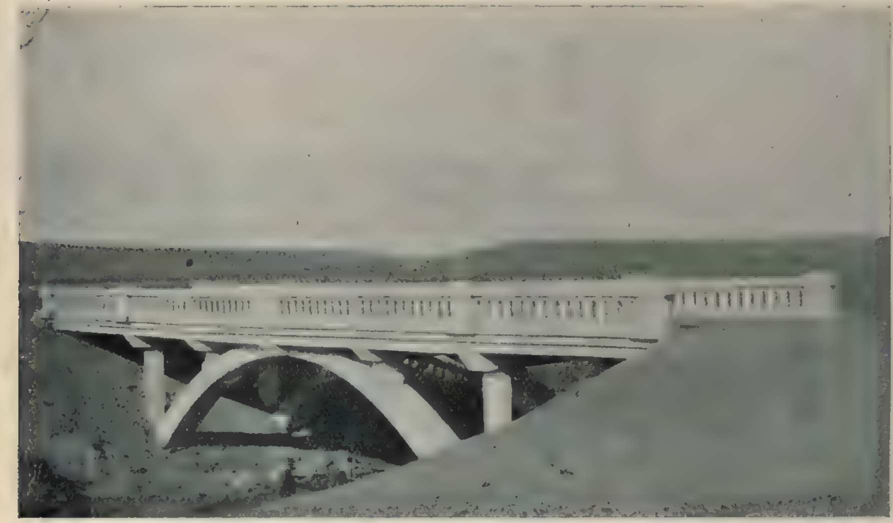


Fig. 7—Design of an open spandril arch built in Woodworth Municipality, Manitoba, in 1917

A bridge of this type was built in Cartier municipality at the following unit contract prices, the contractor supplying all the material:—

Piling per ft. in place	80c
Timber per M. in place	$80

This bridge was over the La Salle river, about five miles from the nearest station. The piles were driven into stiff clay.

Howe Truss on Timber

These bridges have been built where any obstruction of the stream was not permissible and where the amount of traffic did not justify a more costly type. The timber superstructure is of select douglas fir, planed on all sides to reduce the cost and increase the inefficiency of painting.

Howe Truss on Masonry

This type of bridge has been built on important roads on which it was thought that the traffic did not at present justify a more costly type of bridge, but where eventually the increase in traffic would justify a steel bridge. The following are the unit prices obtained on a bridge recently constructed over the Assiniboine river at Headingly:—

River excavation	$11.00 per cu. yd.
Shore excavation	3.30 per cu. yd.
Piling in approach span	1.00 per lin. ft.
Cement, in place	3.50 per bbl.
Concrete, not including cement	16.00 per cu. yd.

This bridge consisted of four spans each 90 feet long, with a 45 foot wooden pile approach at each end. The bridge was about one-half mile from the nearest railway station.

Short Steel Spans

Short steel bridges up to 30 feet clear are built of heavy steel I beams. With the present ratio of the cost of concrete to the cost of steel, concrete slab and girder bridges of short spans can be built cheaper than steel spans, consequently very few of the latter have been built in recent years.

Steel Truss on Masonry

None of this type of bridge has been built during the past few years as under present prices the concrete bridge is more economical than the steel bridge. Figure (2) shows a steel bridge of 126 feet span, built in Swan River municipality in 1914.

Figure (3) shows the design of a standard 4 ft. x 8 ft. reinforced concrete culvert. A contract was recently let for a culvert of this type in Daly Municipality at the following prices:—

Excavation	$ 1.50 per cu. yd.

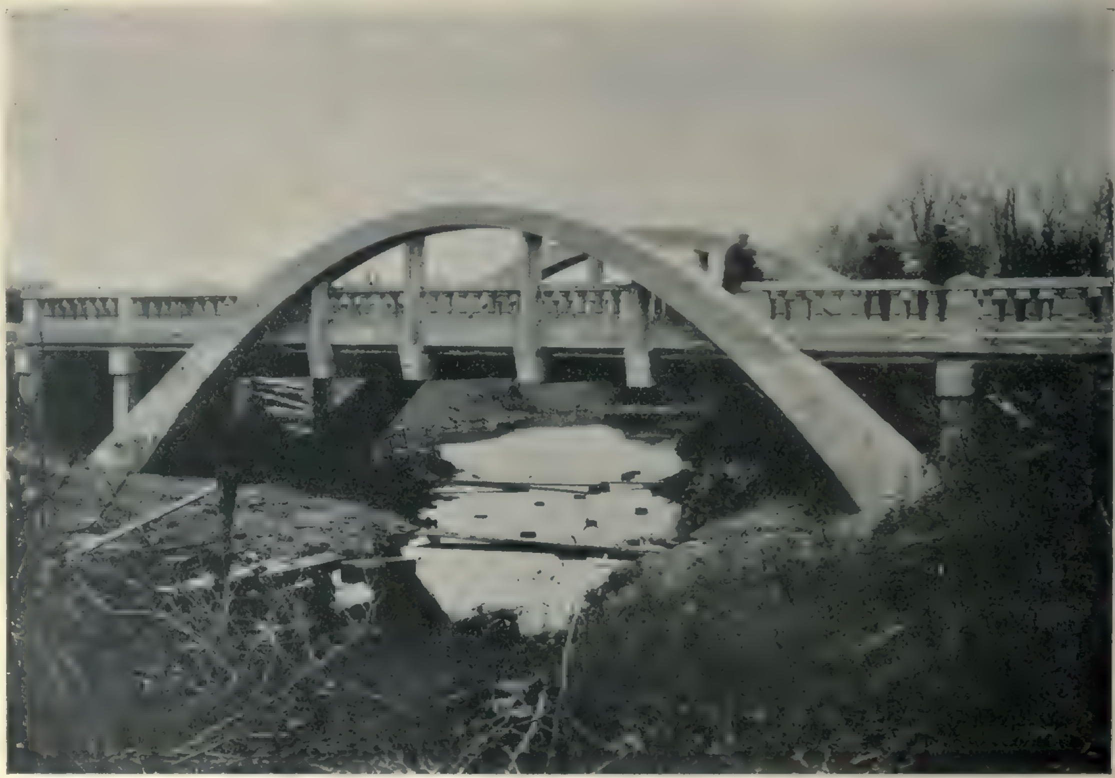


Fig. 8—Design of a half-through arch built in Lansdown Municipality, Manitoba, in 1918

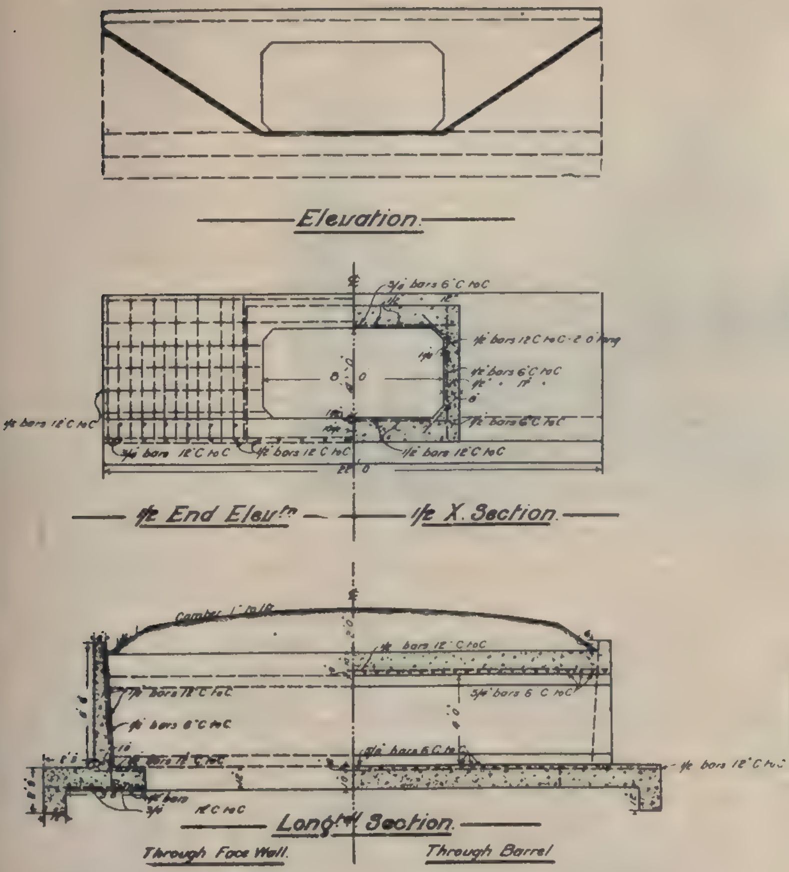


Fig. 3—Design of a standard reinforced concrete culvert as used by the Manitoba Good Roads Board

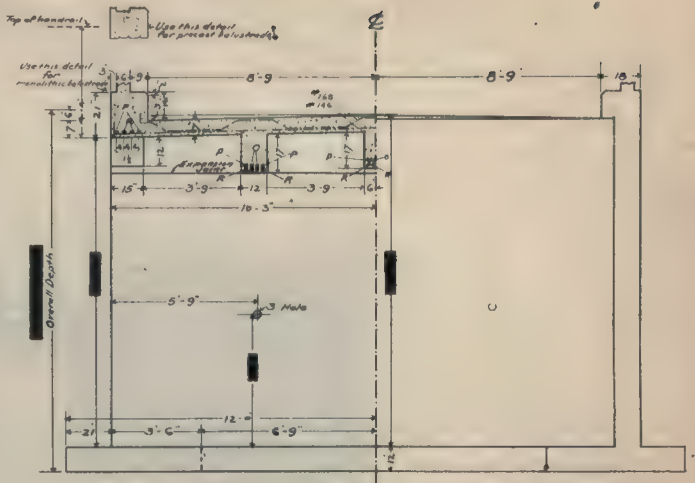


Fig. 4—Half cross section and end elevation of a standard slab and girder bridge

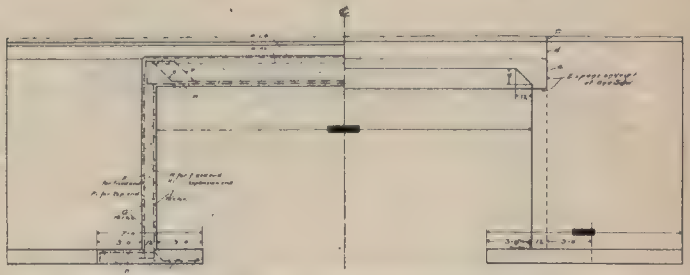


Fig. 5—Half longitudinal section and side elevation of the bridge, Fig. 4

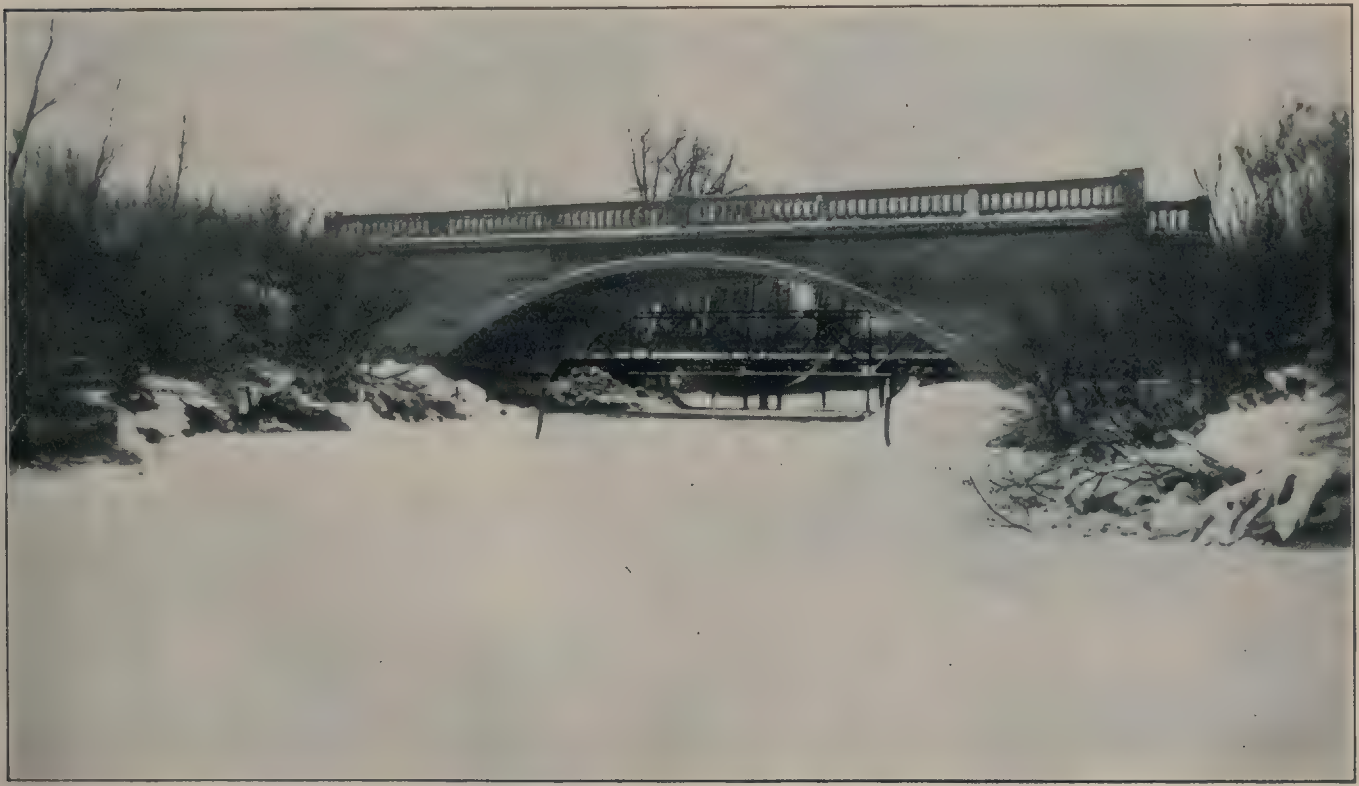


Fig. 6—Barrel arch of 60 feet span, built in Lansdown Municipality, Manitoba

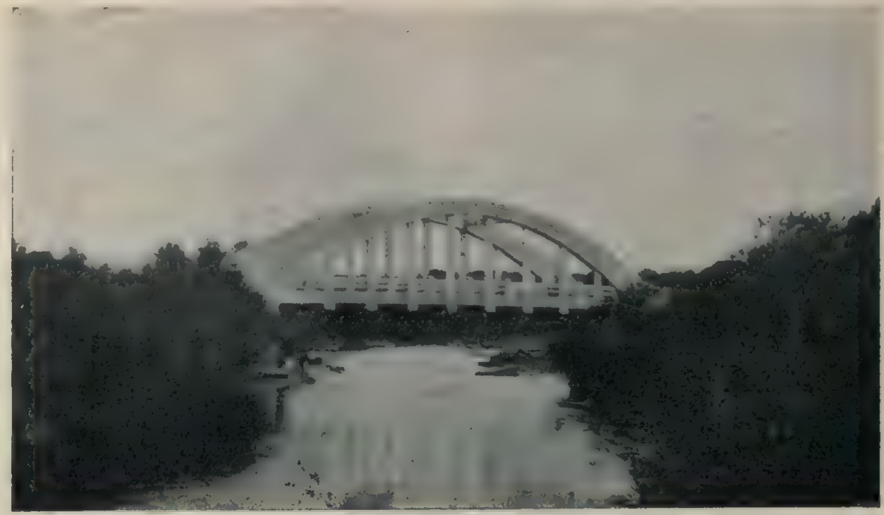


Fig. 10—Design of a 90 feet Bow-string bridge built in Grandview Municipality by the Good Roads Board, Manitoba

Concrete (in place)	17.00 per cu. yd.
Steel (in place)	9c per lb

Concrete Slab & Girder

Figures (4) and (5) illustrate a standard slab and girder bridge. A contract was recently let for a bridge of this type in Pipestone Municipality, at the following prices:—

Excavation	$ 1.75 per cu. yd.
Concrete	18.00 per cu. yd.
Steel..	10½c per lb.
Mesh	15c per sq. ft.
Balusters	1.00 each

This bridge was about six miles from the nearest station. Gravel had to be hauled about 3 miles.

Barrel Arches

Figure (6) illustrates a 60 foot clear span barrel arch built in Lansdown Municipality in 1917. A similar type of structure was built in Cornwallis Municipality in 1919, at the following unit prices:—

Excavation..	$ 2.00 per cu. yd.
Cement..	4.10 per bbl.
Concrete, not including cement	10.00 per cu. yd.
Steel..	8c per lb.

Open Spandrel Arches

Figure (7) shows the design of an open spandrel arch built in Woodworth Municipality in 1917.

Half-Through Arches

Figure (8) shows a half-through arch built in Lansdown Municipality in 1918. A bridge similar to this was built in Grandview Municipality in 1919 at the following prices:—

Excavation..	$ 3.50 per cu. yd.
Cement	3.65 per bbl.
Concrete, not including cement	18.85 per cu. yd.
Steel..	8c per lb.

This bridge was about one-half mile from the nearest station and gravel had to be hauled about three-quarters of a mile.

Bow String

Figure (9) shows the design of a 50 feet bow string bridge and Figure (10) shows a 90 feet bow string built in Grandview Municipality. A 50 feet bridge of this type was built in Portage la Prairie Municipality in 1919 at the following prices.—

Excavation	$ 2.00 per cu. yd.
Cement	4.00 per bbl.
Concrete, not including cement	14.00 per cu. yd.
Steel (in place)	8c per lb.

These types constitute the more usual ones used by this department but occasionally other special designs are used.

Due to the rapid increase in the cost of timber and

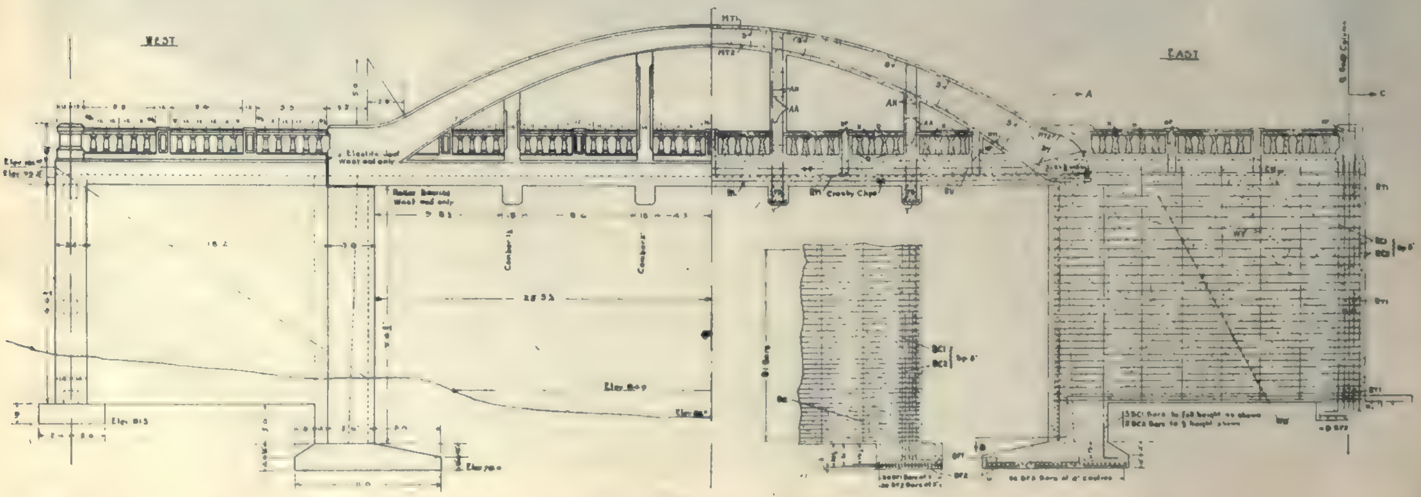


Fig. 9—Design of a 50 feet Bow string bridge built by the Good Roads Board, Manitoba

steel, the prospects are that very few bridges will be built of material other than reinforced concrete, and the outlook is that during the coming season the number to be built will be far in excess of the number built in any previous year.

Standing Committee on Labor Appointed by A.C.B.C.I. Holds First Meeting

THE first meeting of the Standing Committee on Labor, appointed recently by the Executive Committee of the Association of Canadian Building and Construction Industries, took place in Ottawa on May 13th. There were present: J. P. Anglin (chairman) and D. K. Church, Montreal; R. J. Fuller, Toronto; F. W. Dakin, Sherbrooke; Geo. A. Crain and H. J. Graham, Ottawa; and J. C. Reilly, secretary. Telegrams regretting inability to be present were received from Roy Secord, Brantford; Jos. M. Pigott, Hamilton, and Joseph Gosselin, Jr., Levis.

The secretary reported that the Winnipeg Builders' Exchange had appointed Joseph A. Bonnett as its representative on this committee, and read letters from the Minister of Labor and the president and secretary of the Trades and Labor Congress expressing their desire to co-operate with the committee in its work.

A general discussion followed, covering labor conditions in the various cities represented, and dealing with the various clauses of the report of the Labor Committee submitted at the Ottawa conference. The question of the responsibility of labor unions, the dating of agreements, and apprenticeship were fully discussed.

It was decided to have a further meeting of the committee on May 25th, in Hamilton, at which the secretary was instructed to submit data on several of the above matters, for more definite action.

A very pleasant feature of the proceedings was a lunch at the Laurentian Club, the committee being guests of the Ottawa members and Mr. Sid. Smith.

The committee would appreciate it if any local Builders' Exchange or firm or individuals having special information on any of the foregoing topics would submit same to the secretary, or to the nearest committee member, or give any other assistance in the committee's work.

St. John Contractors Form Branch A.C.B.C.I.

Eighty Representatives of Building Industry Prepared To Stand By an Organized Association

ST. John, N. B., contractors are enthusiastic in their support of a branch of the Association of Canadian Building & Construction Industries. At a general meeting held on Friday, May 14th, a large number of representatives of the construction business were present and the general sentiment was to give their support to a St. John branch of the Dominion organization. An earnest start was made and the following were elected officers: J. A. Grant, president; John Flood, Sr., first vice-president; S. Drury, second vice-president; W. J. Crawford, honorary secretary; Chas. Christie, honorary treasurer; Geo. Flood, sergeant-at-arms. After some discussion on the composition of the board of directors, it was decided to elect nine members representing each trade and the following were elected at the meeting: John P. Mooney, general contractors; R. E. Fitzgerald, plumbing and heating, James Pullen, painters, Harold Wilson, sheet metal workers and roofers; George Waring, millmen, structural steel and ironworks; R. A. Corbett, mason contractors; Edward Bates, Jr., carpenters; W. Nonnenman, tiling and marble work contractors; F. P. Vaughan, electrical contractors.

The constitution and by-laws were based upon those of the Ottawa branch, with only minor changes made to suit local conditions and the smaller number of members. The purposes of the branch are as follows:

"To inculcate just and equitable principles; to establish and maintain uniformity in commercial usages; to acquire, preserve and disseminate valuable business information, and to avoid and to adjust, as far as practicable, the controversies and misunderstandings which are apt to arise between individuals engaged in trade; to facilitate the dealing among members of the industry, providing suitable rooms and times of meetings to enable them to meet and transact business, all to the end that membership in this association may be a guarantee to the public of the skill, honorable reputation and probity of those who shall be admitted thereto. To facilitate these objects the association will be divided into three sections, viz: (a) general contractors or contracting engineers, (b) separate or sub-trade contractors, (c) supply firms, manufacturers and producers of building material and plant. Each section may be further sub-divided."

Mr. J. A. Grant, President of St. John Branch A.C.B.C.I.

Eighty members of the building trades in St. John have already signified their intention of becoming members.

Hydro Operations in Ontario for Past Year Show Satisfactory Results

Year Filled with Difficulties Incident Upon Readjustment Following Ending of the War—Details of Various Systems

THE Twelfth Annual Report of the Hydro Electric Power Commission of the Province of Ontario, covering the year ended December 31, 1919, has just been published. The operations of the year are summarized by Sir Adam Beck, chairman of the committee, from which we quote the following:—

The Commission in submitting its Annual Report for the fiscal year does so with a measure of pride in the extremely satisfactory results of the operations of a year which has been pregnant with difficulties, due to the period of readjustment succeeding the successful conclusion of the world war in November, 1918.

Loads Reduced Following Armistice

The year has been fraught with many difficulties, having commenced as it did at the most critical period in the great conflict when every effort was being made by the Commission to supply the enormous demands for power in all districts for the manufacture of munitions. The signing of the armistice came shortly after the beginning of the year, and still more obstacles were encountered during the readjustment period, when the industries throughout the province were returning to commercial lines, during which time the loads on many systems were reduced to such an extent as to seriously decrease the revenues and consequently to embarrass the financial operations of the municipalities on these systems.

At the time of the signing of the armistice, the Commission was supplying power in various parts of the province to over 4,000 plants working on the manufacture of munitions and war supplies. These plants were at that time using approximately 70 per cent. of the total amount of power supplied by the Commission on all systems. Immediately after the armistice was signed most of these plants were temporarily idle until such time as their machinery, equipment and organizations could be readjusted to a peacetime basis, so that for at least eight months of the fiscal year the loads in many of the municipalities supplied had not reached normal proportions, and more especially was this true in the case of those municipalities where large blocks of power had been supplied for munition production. In some of these municipalities the loads declined 25 per cent. or more when the munition loads ceased, and it was not until the month of August that the loads reached normal proportions, from which time the recovery of commercial industries in the province was so rapid that practically all of the available power wes being used by the end of the year.

War Created Big Demand For Power

When the war broke out and there was pressing need for munitions, the Canadian manufacturers were approached by the Government with a view to ascertaining to what extent Canada could participate in supplying these demands, and while many manufacturing companies were willing to convert their entire organizations to the production of munitions, this would have been useless had not the Commission been able during the first three years of the war to supply the large quantities of power necessary to operate these plants.

In 1917 the Commission realized that its reserve of power available for the manufacture of munitions would soon be exhausted, and steps were then promptly taken to augment the supply.

This necessitated the expenditure of large sums of money on the construction of extensions to generating plants, transmission lines and systems, approximately $7,600,000 being expended to produce 54,000 horsepower, all of which would have been available for munitions manufacture. The Commission also made arrangements whereby the Ontario Power Company of Niagara Falls was relieved of supplying 10,000 horsepower for export, in order that this additional power might be available for munitions manufacture.

The cost of the above extensions was greatly increased by the rapid rise in the cost of labor, equipment and materials. In purchasing the equipment for these emergency plants it was found to be impossible to obtain all the necessary machinery and equipment in Canada, and no course was open but to purchase much of the apparatus in the United States in order that these plants might be constructed in the shortest possible space of time in order to be available for the supply of power for munitions production. On this account the Commission was obliged to expend large sums in duties and war taxes, amounting to over $652,000, or an average of 37½ per cent. of the purchase price.

Labor Situation Acute

During this period the labor situation was acute; not only was it almost impossible to obtain sufficient labor to carry on the work expeditiously, but the cost of labor had nearly doubled over that of pre-war days. Moreover, as is generally known, the efficiency of labor had decreased in proportion to the increase in the cost of same. The general scarcity of labor and increase in wages during the year resulted in the amount of the operating pay-rolls increasing in many cases by more than 60 per cent. over that of the previous year. The cost of materials also increased approximately 25 per cent. These factors had a most serious effect upon the operations of the Commission and were utterly beyond the power of the Commission to control, as has been the case with industries of every nature throughout the province.

However, in spite of the enormous, uncontrollable increase in operating expenses, the revenues of the Commission have been in the main sufficient to meet all operating expenses and necessary fixed charges, practically the only exceptions being those municipalities in which large blocks of power were supplied for the manufacture of munitions, and which after the cessation of hostilities were not replaced by commercial loads until late in the year. In most of these municipalities the building up of loads to normal conditions during the coming year will place them on a paying basis, and where such is not the case a readjustment of rates may be necessary.

Schedule of Rates

At the beginning of the year, the Commission fixed a schedule of rates covering the estimated cost of service to all municipalities. These rates brought in a total revenue of $3,729,705.75, while the actual cost of service was $3,860,700.79, which includes the total expenses for interest, cost of power, operation and maintenance, amounting to $3,243,329.02, and all the necessary fixed charges and reserves, such as sinking fund, reserves for renewals and contingencies, amounting to $617,371.77. After meeting all operating expenses and setting aside the reserves as above set out (in accordance with Section 23 of the Power Commission Act) the expenditures exceeded the revenue by $130,995.04; the cost of service to all municipalities exceeding the estimates by but 3.5 per cent., a very remarkable showing in view of the phenomenal increase in the cost of labor and material. Bills and credit memoranda have been sent to the municipalities for the difference between the actual cost of service and the bills as rendered, which have already been taken up and incorporated in the books of the municipalities.

Audit

In addition to that audit carried on under the direction of the auditor for the Province of Ontario, covering the period from the appointment of the Commission to the end of the fiscal period, October 31st, 1916, it was ordered and directed by an Order-in-Council dated May 3rd, 1916, that an independent audit and investigation of the Commission's records and books of account was to be made and for this purpose the accounting firm of Messrs. Clarkson, Gordon and Dilworth received the appointment under this Order-in-Council and shortly after its issuance commenced their duties. Messrs. Clarkson, Gordon and Dilworth completed their investigations and audit February 16th, 1918, which, as before stated, covered the activities of the Commission from the date of its appointment, 1906, up to and including the last day of the fiscal year ending October 31st, 1916, and their report was duly presented to the Treasurer of Ontario. Subsequent to this date and at the request of the Commission, the auditors were instructed to make in like manner an audit of the accounts for the year 1917, which was done and reported upon to the Provincial Treasurer under date of August 22nd, 1918. As appointees of the Commission the audit was continued by the same firm and completed under date of April 16th, 1919, for that period ending October 31st, 1918, since which time a continuous monthly audit has been carried on, and the latest report covers the period ending October 31st, 1919, and was submitted under date of April 3rd, 1920.

Niagara System

Early in the year 1917 the Commission realized that the enormous demands for power for war munition work would soon exhaust the available supply in the Niagara district, and in the summer of that year the Ontario Power Company of Niagara Falls, which is owned and operated by the Commission, approved of an expenditure of over $2,000,000 to install a temporary pipe line and two additional generators having a total capacity of approximately 45,000 horsepower, to obtain additional power for munition manufacturing in this district. By installing a temporary woodstave pipe line, over a year's time was saved, and water was turned into the pipe line within a year from the date the construction work was started.

On December 31st, 1918, the Toronto Power Company ceased to supply the Ontario Power Company of Niagara Falls with 11,000 horsepower that was being supplied under the Power Controller's orders, and on March 1st, 1919, a further block of 13,200 horsepower was cut off. The extension to the Ontario Power Company of Niagara Falls was sufficient to take care of these reductions in power supply and of an additional 21,000 horse-power for additional loads on the system.

At the time of the signing of the armistice, the Commission was supplying over 80,000 horsepower to 360 plants working on the manufacture of munitions. Within eight months after the signing of the armistice, the industries in the district had absorbed all of this available power, and so rapid was the recovery of the industries, that before the end of the year all of the available power supply was used up and it was necessary for the Commission to limit the amount of power supplied to the municipalities on this system.

Anticipating a shortage of power, the Commission is negotiating for an additional supply, and expects to obtain at least 20,000 horsepower for this system early in the coming year.

Queenston-Chippawa Development

The construction work on the Queenston-Chippawa development, which was commenced in May, 1917, has been pushed night and day since that time. This work, however, has been carried on under great difficulties owing to the scarce, inefficient and unstable common labor supply.

Since this project was started, the vast increase in the prospective market for power has necessitated increasing the capacity of the power canal which, together with a corresponding increase in the capacity of the generation station, will greatly add to the capital cost of the development, and, based on this increased capacity and with construction under constantly increasing cost of labor and materials, the development will cost much more than the original estimate for the scheme of smaller capacity.

The estimated progress schedule for work on the development was maintained in all important particulars except in rock excavation, which, on account of the above mentioned labor difficulties, is somewhat behind our estimated schedule, but present progress shows marked improvement and is greater than schedule.

In the construction of the canal for this project it was necessary for the Commission to acquire approximately 3,100 acres of land, of which approximately 1,000 acres will be ultimately required for construction purposes.

The route of this canal traverses, in the most part, very valuable properties, cutting through orchards, vineyards, small fruit and farming districts in such a manner as to preclude the possibility of securing such sections of land only as might be necessary for construction purposes. This fact necessitated the acquirement, in some cases, of farms intact and tracts of land not necessary for the ultimate requirements of the works and which will later have to be disposed of by the Commission when the construction work has been completed.

In connection with this surplus land, the Commission was faced with the problem of how best to deal with such valuable lands. To allow them to remain idle during the period of construction—four or five years—was considered to be unjustifiable, and to rent the properties at an equitable figure in view of the circumstances, was found to be impossible. It was therefore decided to operate these lands in order to maintain them in such a condition that they could be sold advantageously when the construction work on the canal has been completed. It was not anticipated, however, that the revenue obtained from such operation would be sufficient to meet all costs in connection with the farms, but it is expected that the revenue from crops and fruit yield during the next two years will materially reduce operating deficits.

Assuming that the total sum not covered by revenue to date is all charged by way of maintenance or betterments to the property, it is found to be a reasonable percentage, viz: 5 per cent, of the total amount expended on right-of-way.

Severn System

The abnormal demands for power for munition manufacture by municipalities on this system made it necessary for the Commission to extend the Big Chute generating station, at a cost of approximately $215,000.00, from which extension an additional 2,000 horsepower was obtained for munition work.

After the armistice was signed, the loads on the Severn system decreased over 25 per cent. in those municipalities supplying large blocks of power for munition manufacture, and had not reached normal conditions at the end of the year.

An increase in operation and maintenance of the system during the year of $18,168.34 or 47 per cent. together with an increase in interest charges—largely due to the increase in the power plants—amounting to $19,294.73 or 54 per cent., prevented this system from giving as favorable an operating statement as was anticipated, the actual cost of the service exceeding the estimate by about 22 per cent. With the restoration of normal conditions, satisfactory operating results are confidently anticipated.

Eugenia System

This system having a large storage capacity, is used during periods of the day to supply power to the Severn system, and credit is allowed this system on account of such power supplied. The dropping off, however, of munition loads on the Severn system reduced the amount of power used by that system during the year, and seriously affected the revenue of the Eugenia system.

The operation and maintenance expense increased by $17,493.41, or 50.7 per cent. over the previous year, and the interest charges increased $8,708.52, or 17.1 per cent. over those of 1918. However, the actual cost of operation, maintenance and the necessary fixed charges only exceeded the estimate by approximately 5.9 per cent.

During the year a large number of municipalities in the Bruce Peninsula applied to the Commission for power, and many of them are arranging to submit hydro by-laws to their electors at the coming municipal elections. It is expected that with nominal rate adjustments and these additional loads the financial operation of this system will be entirely satisfactory.

Wasdell's System

The generating plant of the Wasdell's system differs from the other generating plants supplying power in the Northern district, in that it does not depend on the storage of water for its continuous maximum output, and this characteristic is of considerable value to the municipalities in the Northern district, as all the generating plants in this district, with the exception of the Muskoka system, are tied together, and power may be used to maximum capacity of this plant throughout the day so as to permit the other generating plants in the district to increase their water storage.

The cost of service during the year increased the amount of the power bills as rendered, by $2,490.01, or 7.7 per cent., due to the fact that the operation and maintenance expenses increased 18.5 per cent., and the interest charges 8.3 per cent., while at the same time the decrease in demand for power for munition plants on the Severn system, cut down the transfer of power to that system. Plans are under way to secure additional load to the capacity of the generating plant.

Muskoka System

The operation and maintenance expenses of this system increased $2,235.54, or 26 per cent. over the figure for 1918, and the interest charges increased over the figures for 1918 by $871.62, or approximately 11 per cent. This large increase in operating expenses, with a fixed revenue from the Anglo-Canadian Leather Company, which is being supplied with power under a long-term contract at a rate based on normal operating expenses, resulted in this system operating with a deficit for the year of $2,469.32.

Arrangements are now being made to increase the amount of power available on this system, for which a demand already exists, which should place the operation of this system on a more satisfactory basis.

St. Lawrence System

The operation of this system was first commenced in December, 1913, a contract being made with the M. F. Beach Power Company for 500 horsepower to supply power to the municipalities in this district.

In order to supply the increased loads in the district and to supply power to other municipalities which had made application to the Commission, a contract was made with the Cedars Rapids Transmission Company, this power being delivered at a high-tension station constructed at Cornwall. Power was first received from this new station on May 1st, 1919. This extension increased the capital expenditure from approximately $180,000 to over $570,000, and the load supplied in this district increased from less than 500 horsepower to over 2,000 horsepower during the last six months of the year.

The actual cost of operation, maintenance and the necessary fixed charges for the year increased by $6,078.93, or approximately 11 per cent. The load is growing rapidly and more favorable results are anticipated during 1920.

Thunder Bay System

During the past ten years power has been supplied to Port Arthur by the Commission under a contract for power received from the Kaministiquia Power Company. This contract expires in December, 1920, and at the request of the municipalities in this district, the Commission commenced the construction of a development on the Nipigon River at Cameron's Falls, in the fall of 1918.

The ultimate capacity of this plant will be 75,000 horsepower. The first installation will have a capacity of approximately 30,000 horsepower, and it is expected that the plant will be ready for operation about December 1st, 1920.

Rideau System

Power was first supplied to this system from the Merrickville plant where the Commission had a contract for 500 horsepower, and while this plant was sufficient to supply the needs of the district during the first year's operation, the rapid growth in the loads of the municipalities supplied necessitated the Commission going ahead with the development of High Falls on the Mississippi River, which development, when completed, will supply approximately 3,000 horsepower. The first unit of this plant will be put into operation about May, 1920.

Central Ontario System

Just prior to the signing of the armistice, this system was fully loaded and the installation of a third generating unit of 3,750 k.v.a. capacity was in progress at Healey Falls in order to meet the increasing demand. When the war terminated, the munitions load fell off abruptly, the decrease being nearly 30 per cent. of the total pre-armistice load. After a period of quiescence, new loads began to develop so that by the beginning of the last quarter of the year normal conditions had again returned. As a consequence of the inactive period the revenues of the power department declined by 30 per cent., and the local systems by 11 per cent. from those of the previous year. Advancing wage rates and material costs resulted in an increase of 12 per cent. in the cost of operation of the power department, while the operating costs of the local systems declined by 10 per cent. owing to decreased power demand. The fixed charges of the power department increased by 12 per cent. owing to completion of the Healey Falls development and, as during the greater part of the year the capacity of the new unit was not required, this increased the burdens of the system without bringing any compensating revenue.

The operation of the pulp mill, which had been profitable previously, was conducted at a loss this year owing to low market prices and advancing manufacturing costs. Since the end of the year market conditions have entirely changed and the operations of the mill are now yielding very large profits.

Since August, 1919, the demand for power on this system has increased to such an extent that all available generating plants are fully loaded and construction work on a new 10,000 horsepower development at Ranney's Falls will be commenced this spring.

It is expected that the increased loads will return sufficient revenue to bring about profitable operation in almost all municipalities and that in cases where rate increases are necessary through rising costs, these increases will not be large.

Nipissing System

The increase in loads on this system during the year was such that the demand for power exceeded the capacity of the hydraulic generating plant and necessitated the operation of the steam plant during low-water periods of the year. The operation of this steam plant, with the increased cost of coal as well as the increased cost of operation and maintenance of the plant, seriously handicapped the system and resulted in a net operating loss for the year amounting to $1,089.53.

The installation of storage dams will be completed some time during the coming summer, so that during periods of high water, the water supply may be stored, and thereby obviate the necessity of operating the steam plant during low water periods, and with this change the operation of the plant should show a good surplus.

Large Public Garage in Montreal, P.Q.

Concrete Structure Partially Built in Winter—Ramps Connect the Floors—Service Facilities

THE Arena Garage, St. Catherine Street West, Montreal, recently completed, is an example of the splendid facilities now provided for the repair and storage of motor cars and trucks. Buildings of this character must be substantially constructed of fire proof materials, exterior ornamentation having no place in the design.

The structure is of concrete and brick, on an area of 32,000 square feet. The exterior walls are of concrete, with a brick facing, the exterior pillars being of the same construction. The interior partitions separating the various rooms are of terra cotta and brick; the floors, of concrete, have a slight slope to the centre to insure good drainage. The water is carried into one main drain, and from there into the civic sewers.

Excavation work for this building was commenced last August, but owing to labor troubles it was well on in the winter before the concrete work was finished. When the cold weather set in difficulty was encountered in getting the concrete set; this was, however, overcome by heating the mixture before it was poured into the forms. The forms were also left a little longer than is usual so that the concrete would be properly set.

Each bay, 24 ft. x 25 ft., provides space for three cars, the floor being marked off with concrete guides to prevent cars coming in contact with one another. The aisles, which are twenty-one feet wide, give ample space for cars to be moved.

Access to the upper floors is by means of a concrete ramp, which is 80 feet long and built on a 15% grade. The ground floor consists of automobile showrooms and service station besides space for approximately fifty cars. Washing racks are placed on each floor, while on the ground floor there is a large workshop for the chauffeurs and owners who desire to make minor repairs to their cars.

The other two floors contain space for about 150 cars, besides chauffeurs' recreation and refreshment

No. 18

Canada's Contractors—W. M. Irving

Mr. W. M. Irving, general contractor, Montreal, is a well known figure in the contracting circles of that city. He has been president of the Montreal Builder's Exchange for the past two years, and has always taken a keen interest in all affairs relating to constructional activities.

Mr. Irving was born January 2nd, 1872, at Southwick, Scotland. On the completion of his education he entered his father's contracting business as an apprentice. In 1904, he came to Canada and was associated with the firm of John Stewart & Company, contractors, Montreal, till 1906. From 1906 to 1908 he was with the Canadian White Company, and in the latter year went into business for himself. Since he commenced business, Mr. Irving has made a specialty of building residences, some of those recently completed being for the following: Mr. William Yuile, Montreal; Mr. G. E. Birks, Montreal; Mr. I. P. Rexford, Montreal; and Mr. F. E. Skelton, Montreal. Mr. Irving also built the University Club, Montreal; the factory for the B. J. Coghlin Company, Limited, Montreal, and the MacFarlane shoe factory, Montreal.

Mr. Irving returned last January from a trip to the Old Country, during which visit he studied labor conditions in England and Scotland, and in his presidential address at the annual meeting of the Montreal Builders' Exchange he spoke of the labor conditions in those countries. In this address he also referred to the great need of stability in the building trade and declared that stabilization was the most important problem now on hand.

Mr. W. M. Irving

Mr. Irving is also a member of the Engineers' Club, Montreal Amateur Athletic Association, and the Heather and Thistle Curling Club.

rooms, ladies' waiting room and chauffeurs' employment bureau. Another feature of the garage is the electric signal service reaching all the floors. Lockers fitted with a tire compartment, size 15 in. x 40 in. x 40 in., Robe rails, shelfing and clothes space are also furnished to patrons. A club room fitted with lavatories and shower baths, is situated on the first floor for the use of chauffeurs. Provision has been made for an additional storey. The building was designed by Mr. J. Archibald, architect, Montreal, the general contract being carried out by Munn & Shea, Montreal. The cost was $150,000.

Upper—Construction view of Arena garage, Montreal. Lower—building nearly completed

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Estimates and plans are being prepared by the engineers of the Hydro-Electric Power Commission of Ontario for a steam reserve plant, which will be located in Toronto, Hamilton, Windsor or Niagara Falls. The plant will require 15 or 20 acres, and negotiation will be conducted with the above cities before decision is made regarding location. Sir Adam Beck states that the first unit of the plant will generate 50,000 h.p. and will turn over by the fall of 1921.

The Board of Control at Ottawa has refused the request of Messrs. McDougal Bros., contractors on the St. Patrick Street bridge, to be allowed to increase their tender on this work. The contractors are now faced with a demand for increased wages from the laborers, who have threatened to strike unless their demands are met. The contractors tender was $172,108.

The growth of the pulp and paper industry in Canada has been a remarkable one. In 1881 there were five mills in this country, capitalized at about $52,000, and producing annually about $62,000 worth of products. To-day there are over 90 plants in Canada capitalized at about $200,000,000, and producing about 5,000 tons of paper daily at an annual value of about $100,000,000.

Preparations are Made for the Most Sucessful Convention of the Canadian Good Roads Association Ever Held

(Continued from page 475)

Roads Association, for election of directors and officers, and reception of annual report and financial statement.

Thursday, June 3rd.

Fifth Session

10.00 a.m.—

Presiding Officer, Hon. S. J. Latta.

Address: "Schools for Highway Engineering," by General C. H. Mitchell, Dean, School of Science, University of Toronto.

Paper: "Highway Bridges and Culverts," by M. A. Lyons, Chief Engineer, Good Roads Board, Province of Manitoba.

Paper: "Asphaltic Concrete Pavements," by W. H. Connell, Consulting Engineer, Philadelphia, Pa.

Paper: "Cement Concrete Roads," by W. P. Near, City Engineer, St. Catharines, Ont.

Noon—Luncheon and drive.

Sixth Session

2.30 p.m.—Presiding Officer: A. McGillivray.

Address by W. Findlay, business manager The Globe, Toronto, Ont., on "The Value of the Local Association in a Nation-Wide Highways Movement."

Paper: "The Importance of Keeping a Traffic Census" by W. A. McLean, Deputy Minister of Highways, Province of Ontario.

Paper: "Refined Tar in Construction and Maintenance," by Andrew F. Macallum, C. E., Commissioner of Works, City of Ottawa.

Paper: "Road Oils and Carpet Coats," by J. A. Duchastel de Montrouge, City Manager, Outremont, Que.

Mainly Constructional

East and West—From Coast to Coast

The Georgian Bay Cement Works at Owen Sound, Ont., will, in the near future, expend $75,000 on new kilns and machinery.

The Barrett Roofing Company have taken out a permit for a $150,000 warehouse which will be erected at the corner of Keating and Saulter streets, Toronto.

Building figures from Calgary show a total of $809,000 in building permits issued for the first four months of the present year, compared with $603,900 for the entire year of 1919.

The city council of Windsor, Ont., at a recent meeting decided to adopt the Government's 1920 housing scheme, which places the sum of $1,500,000 at the city's disposal for the erection of workmen's homes.

For the purpose of encouraging house building in Kingston, Ont., a by-law was presented to the ratepayers recently, and subsequently passed, exempting all dwellings to the value of $2500.00, erected during 1920 or 1921, for a period of five years, from taxation.

The Vancouver Board of Harbor Commissioners are considering the advisability of connecting the north and south shores of Burrard Inlet by a dam and filled area. Major Swan, the board's engineer, has been instructed to prepare plans for such a project.

Mr. J. B. Detweiler, local manager of the Steel Company of Canada's branch at Brantford, Ont., was presented with a club bag recently by his fellow employees on the occasion of his resigning the above position to take charge of the Bluebird Manufacturing Company, Brantford, of which he is president.

The new paving plant at Chatham, Ont., commenced operations recently. The estimated capacity of the plant for the season is 125,000 yards of three-inch pavement, or, approximately, 100 miles. The plant is creating a good deal of interest and representatives of several western cities and towns have inspected it.

Messrs. D. A. Boyd and John Mowat have secured the Saskatchewan rights for the manufacture of concrete slabs, and have opened temporary offices in the Sterling Trusts Building, Regina. Mr. Boyd announced recently that it is their intention to erect a factory in Regina for the manufacture of the slabs.

Personal

Mr. H. L. Suthern has resigned as sanitary inspector at Welland, Ont.

The Jackson-Lewis Co., Ltd., general contractors, of Toronto, will occupy new offices in rooms 503-504 Ryrie Building, 220 Yonge St., after May 29th.

Mr. James Milne has been appointed waterworks inspector at Stamford, Ont., and will shortly make a complete inspection of the town's waterworks system.

Mr. R. R. Beebee has been appointed assistant engineer at Fredericton, N. B. Mr. Beebee will assist City Engineer McDowell on the extensive paving program planned for the coming summer.

Messrs. Kent & Paquette, excavating and road contractors, have opened offices at 1008 Delorimier Ave., Montreal, and will be pleased to receive prices on material and catalogs on equipment.

Mr. G. J. Stephenson, of Paynton, Sask., a returned soldier, has been appointed resident architect of the federal department of public works for the province of Saskatchewan, with headquarters at Regina.

Mr. Thomas Adams, town planing adviser to the Dominion Government, sailed on the S. S. Melba recently for England, where he will represent the Civic Improvement League at the International Congress on Housing.

Mr. J. M. Brown, who resigned as engineer at the Dominion Power & Transmission Company's plant, Hamilton, recently, was presented with a handsome club bag by his fellow engineers. Mr. Brown has accepted a position on the Provincial Board of Examiners.

Mr. Chas. J. Desbaillets has been appointed engineer in charge of the aqueduct work at Montreal, by the Montreal Water Board. Mr. Desbaillets has been manager and chief engineer of Sherbrooke, Que., for the past three years, and previous to that was connected with the Canadian Westinghouse Company, as district engineer of the Eastern division, for seven years. He has already entered upon his new duties at Montreal.

Obituary

Mr. Lewis Bennett, one of Hamilton's oldest and best known contractors, died recently at his residence, 93 Breadalbane St., following a brief illness. Mr. Bennett was 71 years of age and had been in the contracting business in Hamilton for the past 37 years, retiring but a few months ago.

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks, Sewerage and Roadways

Belleville, Ont.
City contemplates the construction of sidewalks on 18 streets, estimated to cost $16,000. Engineer, J. G. Mill. Construction of tank sewer also planned.

Blenheim, Ont.
Geo. W. Riseborough, clerk for Harwich Township, Blenheim, will receive tenders for construction of tile and open drain.

Chartierville, Que.
Town contemplates the gravelling of roads. Secy.-treas., E. Laudry.

Courtenay, B. C.
Robert McCuaig, Municipal clerk, will receive tenders until June 10th for construction and installation of waterworks system costing $55,000.

East Bolton, Que.
By-law passed authorizing expenditure of $115,889.44 on construction of roads for Town. Secy.-treas., W. E. Juby, East Bolton.

Fredericton, N. B.
Tenders will be received until May 28th for construction of roads in New Brunswick. Minister Public Works, P. J. Veniot, Fredericton. Specifications at Dept. and with Provincial Engineer, St. John.

Halifax, N. S.
Tenders will be received until June 7th for construction of Reserve Road (Cape Breton), 8.3 miles of slag macadam; Liverpool - Caledonia Road, 5 miles of gravel road near Liverpool. Plans with chief engineer for Provincial Dept. Highways, J. W. Roland, Halifax.

Hamilton, Ont.
City contemplates expenditure of $41,469.93 on laying of pipe sewers. Clerk, S. H. Kent.

Langley, B. C.
Municipality plans to expend about $16,000 on road improvements. Engineer, Mr. Breckon.

Merritton, Ont.
Town will receive tenders until May 29th for construction of sewers. Clerk, Richard Clark; engineer, F. N. Rutherford.

Montreal, Que.
Rene Bauset, City clerk, will receive tenders until June 2nd for paving work to cost $51,937. Plans with engineer, A. E. Doucet.

New Toronto, Ont.
E. A. James Co., engineers, Excelsior Life Bldg., Toronto, will receive tenders until June 4th for construction of sidewalks and sewers for Town.

Richmond, Que.
Town contemplates the construction of aqueduct. Secy.-treas., A. V. Glassey.

Ridgetown, Ont.
Town will receive tenders until May 28th for construction of concrete pavement on Main street, 1050 ft. x 46½ ft. Clerk, H. A. Mallory; engineer, J. A. Macdonald.

Riviere du Loup, Que.
Town is having plans prepared for construction of aqueduct and sewerage system. Secy.-treas., E. Talbot.

St. Armand Ouest, Parish of, Que.
Geo. Bradley, secy.-treas. for Municipality, will receive tenders until May 28th for gravelling road.

St. Cesaire, Que.
B. Michaud, Deputy Minister, will receive tenders until June 7th for gravelling roads for Municipality. Plans with engineer, G. Henry, Roads Dept., Parl. Bldgs., Quebec.

Thedford, Ont.
Bosanquet Township will have plans prepared for repairs to Canada Co. Canal. Clerk, Geo. Sutherland, Thedford, Ont.

Toronto, Ont.
W. A. McLean, Deputy Minister for Provincial Dept. Highways, Toronto, will receive following tenders: Until June 9th, for supply, crushing and delivery of 4,200 cu. yds. stone in Charlottenburg Township; until June 9th, for supply, crushing and delivery of 7,000 cu. yards of stone on Highway in Townships of Matilda and Williamsburg; until June 9th, for supply, crushing and delivery of 6,000 cu. yds. of stone on Highway in Lancaster Township. Specifications for above three tenders can be seen at Dept. and at office of resident engineer, Cornwall, Ont.

W. A. McLean, Deputy Minister for Provincial Dept. Highways, will receive following tenders: Until June 11, for extending bituminous macadam pavement two miles or more northerly from Newmarket; until June 14th for construction of concrete pavement, etc., from westernly limit of Hamilton about 9,000 lin. ft., plans to be seen at Dept., with City Engineer, Hamilton, and Resident Engineer, Paris; until June 18th for construction of concrete pavement in Village of Pickering, plans to be seen after May 28th at Dept. and with Resident Engineer, Port Hope; until June 15th for about 3,000 cu. yds. of earthwork on Provincial Highway, ½ mile east of Oshawa, plans to be seen at Dept., and with Resident Engineer, Port Hope.

Tenders will be received until May 29th for construction of concrete sidewalks on various streets for York Township. Plans with Engineer, Frank Barber, 40 Jarvis St., Toronto.

W. A. McLean, Deputy Minister Provincial Dept. Highways, Toronto, will receive tenders until June 9th for grading, etc., in Township of Leeds. Specifications at Dept. and with Resident Engineer, Gananoque, Ont.

Tenders will be received until May 28th for construction of 6 in. cast iron watermains on various streets for York Township. Specifications with Engineer, Frank Barber, 40 Jarvis St., Toronto.

W. A. McLean, Deputy Minister for Provincial Dept. Highways, will receive tenders until June 5th for excavating, construction of concrete structures, etc., in (1) and (2), Burford and Blenheim Townships, Sec. A. and B., and (3), Blandford and East Oxford. Specifications at Dept. and with Resident Engineer, Paris, Ont.

Vancouver, South, B. C.
Municipality of South Vancouver will call tenders shortly for improvements to roads costing $25,000. Commissioner, F. T. Gillespie, South Vancouver.

Wingham, Ont.
Town will call tenders shortly for construction of concrete pavement, curbs and gutters costing $40,000. Clerk, John F. Groves.

Town will have plans prepared for construction of dam. Engineer, Roy Patterson, Goderich, Ont.

Whitby, Ont.
E. A. James Co., engineers, Excelsior Life Bldg., Toronto, have been instructed to prepare plans for paving about ¾ of mile of Town's main streets.

Woodstock, N. B.
Town will call tenders about June 10th for construction of concrete sidewalks costing $30,000. Town manager, R. F. Armstrong.

CONTRACTS AWARDED

Halifax, N. S.
Halifax Relief Commission, Sackville St., awarded general contract for paving work to Bedford Construction Co., Royal Bank Bldg.

Hamilton, Ont.
Barton Township has awarded general contract for construction of cement sidewalk and stone road to Chas. Brayley, 155 Gibson Ave., Hamilton.

L'Acadie, Que.
Town has awarded general contract constructing four miles of road to Richelieu Quarry.

Leamington, Ont.
Town has awarded general contract for paving work to Merlo, Merlo & Ray, Walkerville, Ont., at $3.50 per sq. yd. Cost, $30,000.

Martintown, Ont.
Charlottenburg Township awarded general contract for crushed stone road costing $13,000 to $15,000 to Stidwell & McLean, Cornwall, Ont.

Ottawa, Ont.
City has awarded general contract constructing asphalt pavement on two streets costing $26,000 to Standard Paving Co., Central Chambers, Elgin St., and general contract constructing asphalt on two streets costing $26,000 to O'Leary's Ltd., Bank National Bldg.

Suburban Roads Commission, Thistle

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Coherent Plan of Development for Canadian National Exhibition

THE necessity of a coherent plan of development is recognized by most promoters of projects of any importance or magnitude, whether public or private, to such an extent that the growth of such projects is considered and directed on lines laid down after careful consideration and scientific study of the problem. Articles in the "Contract Record" have frequently urged foresight in the matter of layout of large enterprises with the idea of avoiding the all too frequent lack of coherence and comprehensiveness. An editorial in a recent issue, for example, drew attention to the lack of proper planning in the various buildings of the University of Toronto and the absence of a correlated scheme of development.

In one large public scheme, however, we are glad to see that some interest is being taken along this line. That is the Canadian National Exhibition, the Toronto fair which is the greatest annual event of its kind in the world. Huge sums of money have been spent in providing suitable buildings for the purposes of the Exhibition and the Board controlling its affairs do not intend to be sparing in the future. The value of the Exhibition as a factor in Canadian trade development is widely recognized and the citizens of Toronto cannot afford to hinder its expansion along proper lines.

Now that it is clearly understood that the Exhibition has a prominent and important part to play, efforts are being made to rectify the mistakes of the past and prevent their recurrence. Proper planning of the grounds and buildings needs no defence and a comprehensive and coherent plan for the entire Exhibition is essential. The Ontario Association of Architects has gone on record as being unqualifiedly in favor of a thorough study of the conditions so that the Exhibition will be designed along lines that will provide for every present and future requirement. In a letter written to the press some time ago, by the presidents of the Royal Architectural Institute of Canada and the Ontario Association of Architects, attention was drawn to the matter, and we quote from this letter to indicate the urgency of the situation. The letter states: "We believe the time has arrived when, to ensure the future of this great Fair, it becomes imperative to take up this all important matter of development. This development should be along lines determined by a thorough study of conditions involving the preparation of a scheme that will be commensurate with the character of the Exhibition and its needs. . . We cannot longer continue on the old method of adding building by building and making one extension after another, just as the immediate occasion demands, without due consideration of the problem as a whole. From now on the Exhibition should grow along lines established by a thoroughly well conceived plan, on which problem should be enlisted the best brains and talent that can be procured in this country. . . . The many elements which enter into this problem make the matter one that requires prompt and concerted action, but it does not follow, in so doing, that the city or exhibition association would be faced with an extravagant or impossible expenditure. On the contrary if the situation is not faced now, it will cost considerably more in the long run. . . . The buildings need not necessarily be expensive or showy; simple, well designed buildings, if properly disposed in harmonious groups, will have a beautiful effect." The letter suggests that the preparation of a plan of development should be entrusted to the best professional talent who would be directed in their efforts by the representatives of the Exhibition Board, the Park Commissioner and architects and engineers who would study the whole problem and suggest a scheme for the entire layout.

The Exhibition is a great asset to the city of Toronto and of the whole Dominion. It has involved a large investment which requires every possible protection and every possible encouragement. In order to get the most out of the money and effort that has been spent, let the necessity of a comprehensive plan of development be distinctly and immediately recognized.

La Cie de Pavage de Construction de Levis, Ltd., has been formed to act as general builders and contractors, to construct roads and pavements, etc. The capital is $49,000.

Contract Provisions Proposed by Associated General Contractors

FROM the very nature of construction many of the uncertainties attaching to the building business can never be eliminated. They must either be assumed by the contractor or the owner. Some which are now assumed by the contractor ought by right to be assumed by the owner. Other uncertainties may be eliminated entirely to the advantage of both parties. The improvement of present contract provisions is one of the simplest solutions for this problem.

With these thoughts in mind the Committee on Contracts of the Associated General Contractors of America during the past year has made a study of 113 different forms of contracts of various types. The committee are not prepared at this time to submit a complete form of contract embodying every provision which should be included in a good contract. They have, however approved the following provisions which they recommend be included in every contract made by members of the Associated General Contractors of America. Additional provisions will be submitted from time to time.

Proposed Contract Provisions

1. Action on Bids

Bids should be submitted with the provision that they must be acted upon within a reasonable time.

2. Freight Rate Changes

Bids should be submitted on the basis of existing freight rates, with the provision that in case a change in rates should occur between the time bids are received and the date fixed for the completion of the contract, the contract price should be increased or decreased accordingly.

3. Wage Scale Changes

Bids should be stated and be submitted on existing wage rates, with the provision that the contract price shall be increased or decreased in accordance with any change in such rates before the date fixed for the completion of the contract.

4. Material Price Changes

Bids should be submitted on the basis of existing prices for materials f.o.b. the producer's plant or distributor's yard, with the provision that the contract price shall be increased or decreased in accordance with any change in such price that takes place within the time allowed the contractor to purchase and fabricate his materials.

5. Monthly Estimates

Monthly estimates should include materials delivered and suitably stored as well as materials incorporated in the work.

6. Partial Payments

Certificates should be prepared and delivered to the contractor between the first and tenth day of each month, showing the proportionate part of the contract price earned during the preceding month. These certificates should be paid by the owner by the tenth day of the month. Interest on deferred payments should be paid the contractor at the prevailing rate.

7. Contractor's Right to Stop Work

Under the following conditions the contractor should have the right to stop work or terminate the contract upon three days' written notice to the owner and the architect, and recover from the owner payment for all work executed and any loss sustained upon any plant or material and reasonable profit and damages:

(a) If the work should be stopped under an order of any court, or other public authority, for a period of three months, through no act or fault of the contractor or any one employed by him;

(b) If the architect or engineer should fail to issue the monthly certificate for payment in accordance with the terms of contract;

(c) If the owner should fail to pay the contractor, within seven days of its maturity and presentation, any sum certified by the architect or engineer or awarded by arbitration.

(d) If the owner does not permit the contractor to proceed with construction within a reasonable time after signing the contract.

8. Retained Percentage

The retained percentage should be based on 100 per cent. of the work performed and should never exceed 10 per cent. When the amount retained reaches a total sum, which shall be mutually agreed upon by the owner and the contractor, no further reduction from payments should be made.

9. Surety Bond

Where a surety bond is given, it should be reduced at agreed intervals so as to cover thereafter only that portion of work then uncompleted

10. Penalty Clauses

Wherever any provision is incorporated in the contract for a penalty against the contractor (including liquidated damages), there should also be inserted a provision for a bonus of like amount.

11. Acts of God or Public Enemy

The contractor should not be held liable for results arising from the acts of God or a public enemy.

12. Time Allowed for Completion of Work

The time allowed for the completion of the work should be based on "whether working days" instead of on elapsed time, and, if necessary, allowance should be made for time spent in performing unproductive work made necessary by floods or other natural causes beyond the control of the contractor.

13. Inspection

Where practicable, materials should be inspected at the source so that costly delay may not result from the rejection, at the site of the work, of materials furnished in good faith by the contractor.

14. Force Account Work

Payment for force account work should be made on the basis of the total actual costs of the work, including the actual labor and material costs, rental on equipment, liability insurance, etc., plus a reasonable percentage to cover overhead and profit, total to be not less than 15 per cent.

15. Change in Quantities

In case the actual quantities of any item in a unit price contract are less than the estimated quantities by more than a certain fixed per cent., the unit price paid the contractor for that item should be increased by an amount to be agreed upon. Similarly, a decrease in the unit prices should be made in case

(Continued on page 511)

No. 26

Canada s Engineers—James Gilchrist

Mr. James Gilchrist, A. M. Inst. C. E., vice-president of J. A. Grant & Co., Ltd., engineers and contractors, St. John, N. B., was born in Lanarkshire, Scotland and received his education at Public School, Allan Glen's Science School, and Glasgow and West of Scotland Technical College. He then served a five years' pupilage from 1894 to 1899 with Messrs. Warren & Stuart, Glasgow. During this period he was engaged in the preparation of drawings, specifications, estimates, setting out and measuring up, levelling and surveying in connection with roadways, water and drainage works, light railways and tramways.

On expiry of his pupilage he was appointed chief assistant to the same firm and supervised for them the construction of a reservoir in Ayrshire in addition to a number of smaller contracts. He also acted as engineer and adviser to the trustees of a deceased contractor and completed for them a railway near Edinburgh and a reservoir in Lanarkshire. In December 1902 Mr. Gilchrist obtained a position as assistant to Messrs. Coode, Son & Matthews, London, England, and for four years was engaged in the preparation of drawings, estimates, etc. in connection with large undertakings, principally of a marine character, in various parts of the world. In January 1906 he was sent out to Singapore, Straits Settlements, by Messrs. Coode, Son & Matthews as assistant engineer on the Tanjong Pagar dock works during their construction. This comprised a wet dock of 24 acres and about a mile of deep water quayage outside.

On returning from the East in 1911 Mr. Gilchrist was offered and accepted the position of chief engineer to Messrs. Norton Griffiths & Co. (Canada) for the construction of the harbour works at St. John, N. B., and was employed in this capacity and for a time as agent in charge of these works until he resigned his position in 1916. In 1917 he joined Messrs. Grant & Horne as superintendent of their ship yard at St. John, N. B. and later became vice-president of the reorganized firm now carrying on business of engineers and contractors under the name of J. A. Grant & Co., Ltd. The work carried out by this firm was given in the "Contract Record" of May 19, 1920, in connection with the sketch of the career of Mr. J. A. Grant.

Mr. James Gilchrist, A.M. Inst. C.E.

In 1904 Mr. Gilchrist became an Associate Member of the Institute of Civil Engineers.

Montreal Carpenters Reject Arbitrator's Award

FROM November 21st last until a recent date the General Contractors' Association of Montreal were engaged in negotiations with the local branch of the United Brotherhood of Carpenters and Joiners of America, with regard to wages. After trying to arrange a mutually satisfactory schedule, Mr. J. H. Hunter was appointed arbitrator. He rendered an award in favor of a 48-hour week, and also in favor of men outside the union being employed when union men were not available. The minimum wage was to be 76 cents per hour, with a promise that the men should not take part in a sympathetic strike. The contractors accepted this award, but it was rejected by the men, who claimed a 44 hour week, 80c an hour for the first six months and 90c an hour for the second, and a closed shop. Further negotiations followed and another agreement was drawn up, the representatives, however, declining to pledge their associations. This agreement, which was on the main lines of Mr. Hunter's award, was again rejected by the men. The contractors, on their part, re-affirmed their adhesion to Mr. Hunter's award. It was pointed out that if this award had been accepted the men would have received 76 cents an hour instead of the present rate of 67½ cents, and that carpenters in Quebec and Sherbrooke are respectively receiving 65 cents and 55 cents per hour. At the end of last year the Montreal rate was raised from 60 cents to 67½ cents an hour.

Sewer For Montreal Island Municipalities

BY order of the Quebec Public Utilities Commission an inter-municipal sewer will be constructed to provide for the drainage of Greenfield Park, St. Lambert, Montreal South and Longueuil. The cost will be $88,000 for the completion of a trunk sewer and $75,000 for the outfall. The cost is to be borne by the municipalities on a percentage basis, and the work carried out under a committee representing the councils. Messrs. J. A. Duchastel and W. S. Lea are the consulting engineers, at a remuneration to be approved by the commission, and Messrs. L. A. St. Marie and Ernest Drinkwater resident engineers, "who shall be paid such remuneration as the inter-municipal committee may allow." The Harbor Commissioners will build at their own expense the portion of the sewer which passes over Dominion Government property, but the commissioners have so far not agreed to pay anything towards the cost of the outfall.

Timber Bridge Repairs in British Columbia

Some Methods of Strengthening Old Truss Structures—Filling Often Economical—Paper Read Before the Provincial District Engineers

By T. Kilpatrick*

FROM an economical standpoint the filling of small bridges and some of the approaches to the large ones is an important subject and, perhaps, does not get the attention that it merits. One of the factors against the more general adoption of the scheme in some districts appears to be the uncertainty existing as to whether it is to be charged to the road or bridge vote. This is a question that should be more clearly defined. In other instances it is due to the long haul for the filling material. This can be overcome by the more general use of trucks and tractors.

During the year the cost of timber has increased enormously and much more in proportion than the increase in filling and concrete. For instance, the average cost of flooring is $50.00 per M. in place. This means for a 16 ft. floor and 3 in. plank, $2.40, and 4 in plank, $3.20 per lineal foot of bridge. This larger amount will fill a bridge 5 ft. high at 64 cents per yard for filling. This applies particularly to approaches where no water way is required; again a standard 16 ft. high timber trestle at $50.00 per M. will cost $10.80 per lin. ft. This will allow 41 cents per yard for filling. This, under favorable conditions, should be sufficient.

For the same reason concrete culverts, arches, abutments with reinforced concrete stringers for the shorter spans and concrete piers for the larger ones can comparatively be more economically built now than ever before.

Bridge Renewals and Repairs

In most districts renewals and repairs of bridges are done in a workmanlike and economical manner, but in some districts the work is delayed. Some say this delay is due to the difficulty in getting competent foremen and workmen, others to the delay in having the appropriations passed early enough in the season to enable them to get the necessary material delivered at the different structures and the work done during the favorable weather.

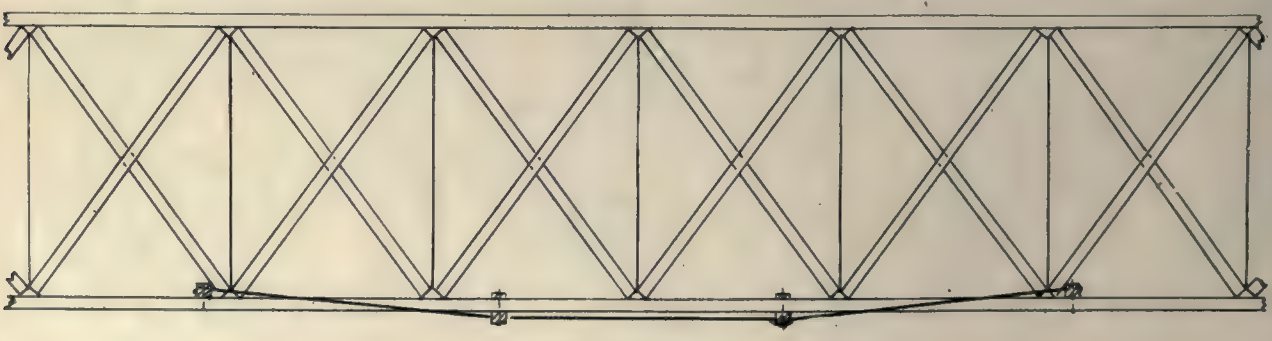
The appropriations should be applied for and granted as early in the fiscal year as possible. This will enable the men in charge of the work to have the necessary material all distributed at the different structures. If this is done it will save the delay which means additional cost for the work.

Before passing this subject I wish to again call your attention to the importance of giving special attention to the tightening of rods and bolts the first and second summer after the erection of all trusses and make sure that only competent truss framers are allowed to do this work.

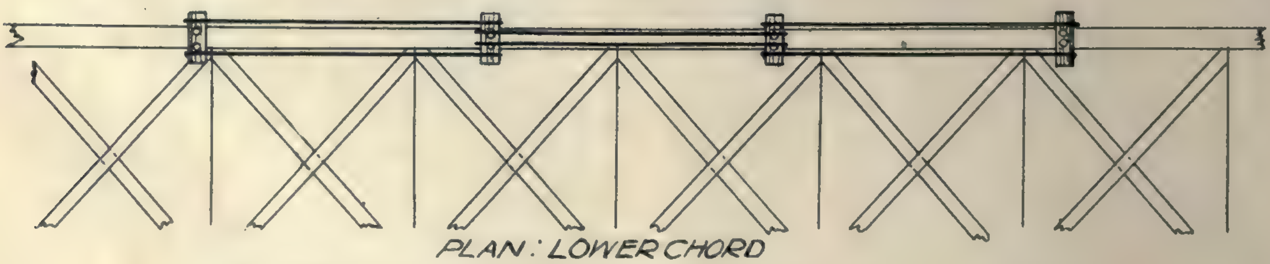
Some action should be taken to cut and clear away all brush and old timber from all bridges to the full width of the roadway.

Recent Partial Failure of Bottom Chords

Columbia River at Revelstoke.—(Six 150 ft. Howe truss spans)—Early last spring the down-stream bottom chord of the two end spans parted. On the west span, the centre leaf, 8 in. x 12 in., pulled apart ½ in. in the third panel from the shore end and the outside and inside leaves sheared or crushed an equal distance at their joints at each end of this break. On the east end span both the centre and outside leaf joints broke in the third panel. Both these breaks were supported temporarily with 3 sets of two old truss rods each, and timber and piles were ordered



ELEVATION



PLAN: LOWER CHORD

Fig. 1—Temporary support for a broken bottom chord with three sets of two rods each

immediately to put on reinforced leaves on these chords and piles to put in extra piers. This chord reinforcing has been done and the east end span shortened 2 panels and the west end span 3 panels with double bent pile piers.

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*Provincial Bridge Inspector of British Columbia.

One of the causes of the failure of these end spans was due to the design. The shore ends are nearly 7 ft. less than the standard vertical height and no difference was made in the length of the panels, consequently the braces at the shore ends have a much less vertical angle, these produced a much greater tensile stress on the bottom chords, resulting in the break, which occurred at about one-third of the length of the span from the low end and not at the centre where the break usually occurs when the upper and lower chords are parallel.

During the summer breaks and shearing developed in the four intermediate spans; fortunately sufficient timber had been provided for the six spans and most of this has been put on.

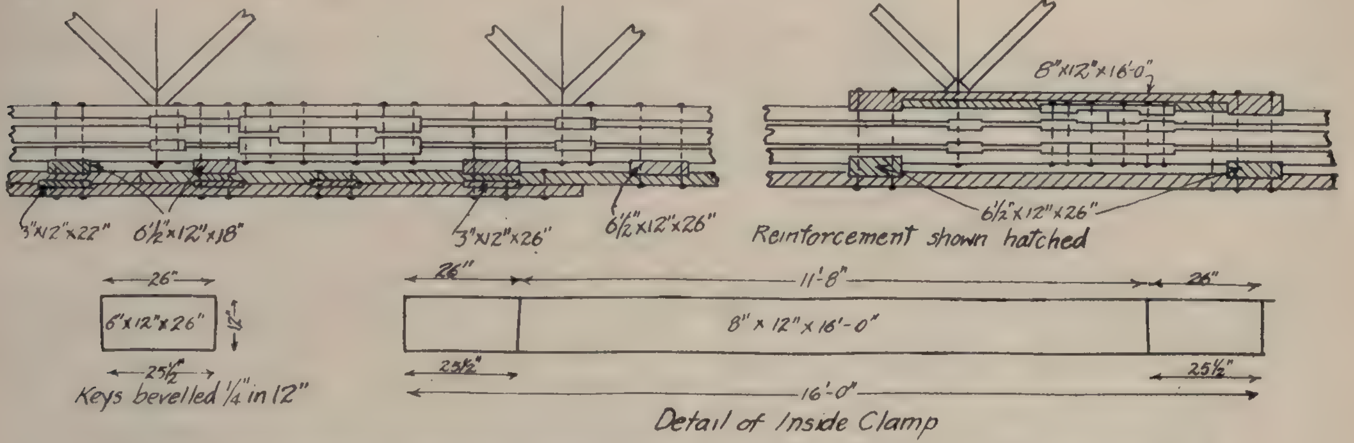

Fig. 2—Method of strengthening bottom chords by reinforcing them with extra leaves on the sides

I inspected this bridge recently and found little or no movement in the bottom chords since strengthened.

Ingraham Bridge.—(Greenwood District, 160 ft. Howe truss span.)—Recently all three leaves in one bottom chord parted. The clamp of the outside leaf joint sheared off in the fourth panel, the clamp of the joint of the inside leaf sheared off in the fifth panel from the west end and the centre leaf is evidently broken under the prism between these. These joints are open from 2¼ in. to 2½ in., allowing a sag of between 2½ in. and 3 in. in the truss, and all that is holding the tensile strain are 8 ¾-in. bolts and one lateral rod. Arrangements were immediately made to keep the traffic to the other side of the bridge as much as possible, limit the load and to put a temporary bent under the centre of the truss, also to have a double bent pile pier, with a good sloping nose at the upstream end put in under the fourth panel from West end. This will make the span good for years.

These breaks are only another proof of the weakness of the present design, chiefly due to decay of the bottom chords caused by the wooden clamps and packing and the absence of properly designed keys between the leaves.

There are many other bridges of similar design throughout the province that have about reached the age when they will require close watching.

The covering of the chords with galvanized iron that has been adopted, if properly put on, will prevent the moisture from the outside reaching the timber, but this does not entirely eliminate the cause of the decay, for if the spaces between the timbers comprising the chords are not left open for the free circulation of air, the sap in green timber is sufficient to cause decay.

Craigflower Bridge.—This was a pile trestle bridge and the recent failure was due to the action of what is commonly known as Soa Lice. It is said that these only attack timber immediately above the ground line in tidal waters.

The upper portion of a pile that had been removed was examined; eighteen inches of the lower end was badly eaten away, particularly near the end, which was of oval form about 3 in x 5 in. in cross-section, and 18 in. above this the pile was sound to its full diameter, about 12 in. The wood was eaten on all sides but not evenly, and was absolutely destroyed as far as it had been penetrated by these worms. There was from ½ in. to 1 in. of honeycombed wood adhering to the good wood on all sides, the balance having eroded.

Careful inspection of all timber work in tidal waters should occasionally be made and if the action of those worms is confined to near the surface of the ground, as above stated, these examinations should only be made at extreme low water.

Some Methods of Strengthening Old Truss Bridges

Fig. 1.—Plan of temporary support for a broken bottom chord, with 3 sets of 2 rods each. In most of the districts there are old truss rods that can be utilized for this purpose; these can be put in quickly and will add much support until the necessary men and material are available to put in a more permanent method of srengthening.

Fig. 2.—Plan of an effective method of strengthening bottom chords by reinforcing them with extra leaves on the sides. This plan shows a usual method of putting a reinforcing leaf on the outside and an extra long chord bolts, and in some instances it may have weakened; by this method the outside leaf can, with thick keys, be put on without interfering in any way with the bolts or rods of the old chord, except that it may be necessary to cut off the ends of some extra long chord bolts, and in some intsances it may be found necessary to shorten some of the lateral braces to allow the extra inside clamps to be put on.

If necessary an extra leaf may be put on the in-

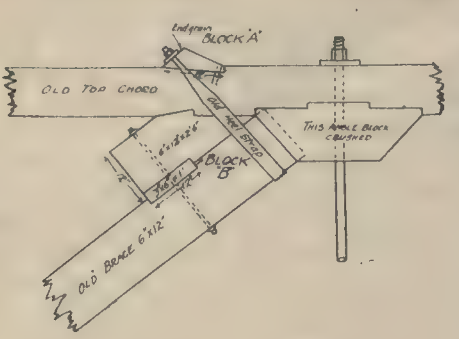

Fig. 4—Method of temporarily supporting the upper end of a main brace when the angle block is crushed

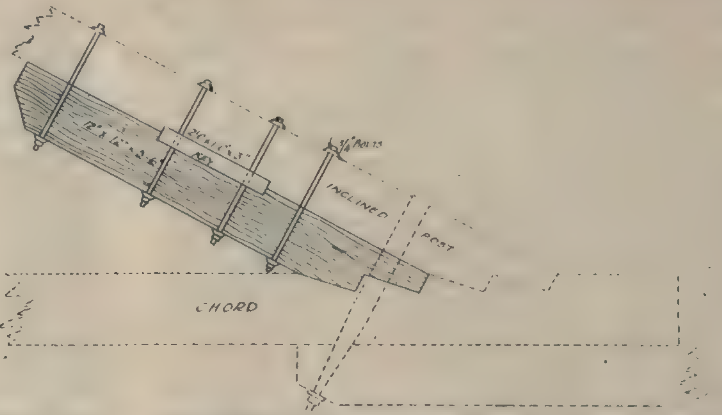

Fig. 3—Method of strengthening lower end of inclined post and bottom chord of King and Queen trusses

side, but this requires much more labor putting in a temporary system of lateral bracing and shortening the old braces.

When doing this work care should be exercised in cutting the key seats in the old chord to keep these as far as possible in the direction of the tensile stress from the clamps or packing of the old chord.

There is another method of putting on extra leaves by framing them similarly to the leaves in the old chord, putting the keys directly opposite the old keys and clamps and replacing the old chord bolts and lateral rods with larger ones. This method will much increase the expense, and would not be suitable for old bridges with wooden clamps and packing, where the chords are badly decayed. In most instances only a shell of good wood on the outside is left. Under these conditions it would be unwise to further weaken it by cutting away the outside surface.

Fig. 3.—Plan showing a method of strengthening the lower end of inclined post and bottom chord of King and Queen trusses. This is similar to one on a bridge in the Cowichan District and is a cheap and efficient method of strengthening the ends of the design of truss, which invariably give way through decay.

The foot of this additional post may be framed into one or two notches in the chord to suit conditions. If there are floor joists on the chord the ends of one or two of these will have to be cut off at the inside of the chord and the end supported by a piece bolted to the chord.

Fig. 4.—Plan showing method of temporarily supporting the upper end of a main brace when the angle block is completely crushed. One of these was put in before high water this year at the top end of the second set of main braces of a 100 ft. span that had crushed 2 in. into a rotten angle block, and the bridge is still carrying traffic.

Items Which Estimators Sometimes Omit*

Five Components of Cost Which Should be Included in Any System of Estimating if Contracting Service is to be Fully Paid For

THE subject "Cost Estimating" is of unusually wide scope as practically each type of contract work has to be analyzed on its own merits and is subject to special considerations. In all cases, however, the following elements enter and must be given consideration:

Financial Credit
Constructive Skill
Use of Plant
Hazard
Profit

Financial Credit

The contractor should make a carefully prepared schedule of the amount of money which will have to be invested in the proposed work from the time he signs the contract until his final estimate is rendered, and from such schedule he must determine the amount of interest this money will cost and this amount is a proper charge against the work. If this is not done the contractor is merely contributing to the owner this amount.

Furthermore, a careful analysis along these lines will often disclose the fact that a certain piece of work requires a larger amount of money to handle it than is apparent at first glance, and such a condition might work a hardship if not disaster on the contractor in spite of the fact that all other considerations had been taken care of. It is a notorious fact that on certain types of contracts, pay for preliminary work, which may be a large item, cannot be secured through the medium of the regular unit prices until the work has progressed well along to completion.

Constructive Skill

Contractors engaged in business are entitled to receive compensation in the shape of an annual salary for personal services rendered and it is our belief that any computations of cost should include sufficient amount to cover such salary whether it be that of a single individual or various members of a partnership or corporation.

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*Report of Committee on Cost Estimating of the Northwestern Association of General Contractors.

Use of Plant

This item justifies an independent discussion by itself and we suggest that the Association appoint a committee to deal directly with it.

Many specifications include clauses which contemplate making the contractor assume risks which should properly be borne by the site, or in other words, should be at the owner's risk. In making a proposal on such work the contractor has two alternatives—one to protect himself in his proposal against such risks by special provision in his proposal, or secondly, to put a large value on any possible risk which he is asked to stand.

It may be well to add in this connection that while it ordinarily behooves a contractor to be somewhat of an optimist he can well afford to be a confirmed pessimist when figuring this portion of a contract. It is possible this fact more than any other has caused good firms to have to go out of the contracting business.

Profit

As to the necessity of a profit we can all be agreed. As to the amount which must be added as a percentage on the cost, differences of opinion will exist, but it must be remembered that the contracting business is a particularly hazardous one; that it is irregular in volume and that every contract will not necessarily be profitable.

Furthermore, it must be remembered that the average merchant sells goods from his shelves at a profit with a definitely established cost for the goods themselves. The manufacturer sells on short term contracts—his overhead, plant installation and plant maintenance costs are established and regular, and while he may not in all cases be willing to admit it, the manufacturer is practically working on a cost plus basis to-day. The only difference in most cases between his method of fixing prices and that of cost plus construction contract is that the manufacturer can and does add a larger profit for the use of his organization, brains and energy. The contractor must provide his plant, must guess at the cost of it, in place, must guess at the operating cost, must guess successfully if he is to stay in the business as to what the labor market will be, and if he is willing to do this he is surely entitled to a fair margin of profit.

Necessary Factors in Estimating

The following items also enter into most work and must be considered in detail before the preliminary cost of a piece of work can be considered as complete:

- Interest
- Overhead Expense
- Bonds
- Insurance—
  - Employers' Liability
  - Public Liability
  - Fire Insurance
  - Special Risks
- Freight on outfit to and from work
- Moving in and out
- Land Damages
- Camp and other buildings
- Preliminary work
- Hauling materials
- Cost of materials plus freight
- Supervision
- Labor
- Loss on board
- Transportation of Labor
- Tools
- Plant Rental
- Supplies
- Running Repairs
- General Repairs
- Special
- Machinery
- Fuel and Power
- Water

Taking up these items in order we will comment briefly on each.

Interest.—This is covered in our discussion of financial credits.

Overhead.—A contractor should establish the proper cost of the overhead charges in his business. This should include the charges, salary allowance for members of the firm, traveling expenses, etc. Provision should also be made here for the maintenance of an equipment storage yard.

Bonds.—No comment should be necessary here on this item.

Insurance.—It is not necessary to make a discussion of the fact that prudence would require that any combustible material, together with camps, storehouses, etc., should be insured and such insurance is of course a proper item of cost to the work. There are often special risks which occur upon a job which may be protected by insurance, and such insurance is also part of the cost.

Freight on Outfit.—This is possibly a portion of the item following but we have listed it separately because we believe that many contractors under-estimate the amount of freight that they will be required to pay on their outfits in such cases.

Moving In and Out Expense.—This is an item frequently overlooked by contractors but one which requires careful consideration. First, there is expense of loading outfit in the contractors' yard; second, the unloading of it at point of destination; third, the moving of it perhaps many miles across country; fourth, the setting up and getting plant ready to operate, and the reverse of all these operations until the plant is again delivered in the contractor's yard.

Land Damages.—This is an item which we believe many contractors neglect entirely and still it is one which costs considerable sums of money. This seems particularly true in connection with county road work.

Land damages accrue from the use of property for camping purposes, from moving outfits across fields for the diversion of public highways, and for storage yard and other construction layout.

Camp and Other Buildings.—This is another fruitful source of under-estimating by contractors, often in the loose assumption that "The boarding house will pay for the camps." If such a condition ever existed it must have been a great many years ago and we believe that present-day conditions necessitate including the cost of all camps and temporary buildings required to carry on the work. We further believe that contractors should be careful to avoid the thought of high salvage values to avoid subsequent disappointment.

Preliminary Work.—This is an item which should not only be considered in cost estimating but we believe that we should digress from the subject for a moment and call attention to the fact that it is probably a duty which every contractor owes to himself to work out a definite scheme of handling a piece of work before he proceeds with an estimate. This does not mean that he must detail the laying out of an entire piece of work but that he must see clearly that a certain general line of procedure can be followed with expectation of proper results therefrom.

Cost of Materials.—Mention is made of this particularly to emphasize the fact that a cost estimate is usually based on certain material quotations, and it is very necessary in these times that a prospective bidder should be careful to be properly covered with material quotations when making a bid and to close up promptly with the material dealers after the award of the contract.

In connection with this comes a question of freight which must not be overlooked but in case of the present railway situation it would seem necessary for every bidder to make special provision in his proposal to protest against a change in freight rates during the time of the work.

Haulage Materials.—All hauling costs should be very carefully analyzed, as they are often a fruitful source of under-estimation.

Supervision.—Care should be taken to see that any computation of labor also includes any supervision which is not covered in the item of overhead. This would usually mean general foremen, timekeepers, labor agents.

Labor.—Labor is perhaps the most difficult item in the computing of cost which a contractor has to deal with. Rates have been rising for several years and it is apparent that wages have not reached their peak. Provision must be made somewhere to protect against what the bidder considers the maximum rate which will accrue during the life of the contract.

Loss on Board.—In most cases there is a definite board loss in connection with camps. While this may not be true with large camps, working through a considerable period of time, the small movable camp such as is in vogue on highway work usually contributes a constant loss to the work.

Transportation of Labor.—This is an item very often neglected, yet it is very common to have to advance railroad fares to laborers with the resulting increase in the cost of the work.

Tools.—Contractors often fail to make the proper allowance for tools. Careful analysis of work done will show a tool item is a very appreciable one in every contract and will also indicate that tools do not carry any too well from job to job, but that there is a definite and heavy loss on every job in connection with this item.

Plant Rental.—As mentioned before this should be covered by special paper.

Supplies.—This is an item which is often neglected as being a minor consideration. On certain classes of work it is really, instead, a very heavy item. The cost of packing, grease, hose, rubber boots and other rubber goods, should be given careful consideration and the contractor will save himself money by checking up his past work and arriving at a clear understanding of what such costs really are.

Running and General Repairs.—These should be discussed in connection with the use of plant, of plant rental, but in any case the contractor must understand that they are necessary parts of the cost of doing a piece of work.

Special Machinery.—On many contracts it is necessary to employ in addition to an ordinary contractor's plant some special form of machinery either purchased from a manufacturer or built by the contractor for the work. In either case plant rental is not a proper charge for this class of equipment.

The entire cost of it less its scrap value must be charged to the one job on which it is used, otherwise a contractor may complete a large amount of work and find the entire profits tied up in machinery which has little value other than scrap.

Fuel and Power.—The cost of power especially varies so much in different localities that the bidder should acquaint himself carefully with the local conditions. If a large amount of fuel is involved careful allowance must be made for the hauling and handling of same.

Water.—This item often becomes a serious obstacle to the proper handling of work and is one that requires a great deal of attention. It sometimes adds very materially to the cost. In addition to this we wish to impress all contractors with the desirability of investigating the available water supply in connection with a given piece of work before making their figures.

Conclusion

We cannot close the discussion of cost estimating without dwelling for a moment on the question of cost keeping. The fact that so many contracting concerns are closed out of business each year is a strong indication that something is not correct with the way construction work is figured. A good deal of it comes from neglecting a number of items which we have mentioned above and which do not appeal to some men as being of enough moment to give direct consideration to when making figures. Other trouble comes from not keeping careful cost data of work done and analyzing such costs.

It is not the purpose of this paper to go into detail regarding such things, but we believe that a contractor should avoid using manufacturers' statements of operating costs as well as any other stop-watch methods, as they usually spell loss if not disaster. A certain amount of work done per day with a crew operating at a certain expense per day never means that the division of that daily cost by that daily output is the unit cost of the item in question. There are delays and other things which so affect this price that it may be over one-hundred per cent. out from the actual cost when all things are taken into consideration.

Four Jurisdictional Awards

AT the second meeting of the National Board for Jurisdictional Awards, held in Washington, April 26-28, 1920, some important decisions were made which may be of interest to Canadian contractors. Representatives of the A. G. C., the National Association of Building Trade Employers, the American Institute of Architects, Engineering Council and the Building Trades Department of the American Federation of Labor sat as a court of inquiry and handed down awards in four cases.

The most important of these gave the employers full direction over the erection and removal of scaffolds up to 14 feet in height on building construction work, with the option of having the work done by mechanics or laborers in the lathers, plasterers, bricklayers, and masons' unions.

The carpenters and joiners were given jurisdiction in the matter of asbestos shingles, prepared paper roofing, asphalt roofing, shingles and strip shingles, which had been disputed by the slate and tile composition roofers.

The asphalt workers as against the plasterers were awarded the work of putting up asbestos ceilings and insulation on jobs for which were put in the ground work. The carpenters and plasterers are given divided jurisdiction over the installation of Bertwall, a patented product.

Pressure of Plastic Concrete Against Forms

Tests Indicate the Nature of Forces and the Laws of Their Action—Empirical Formula for Design of Forms is Developed

TESTS to determine the pressure of plastic concrete against forms have been made by the U. S. Bureau of Public Roads. While these tests seemed to accord in general with the results obtained by other investigators, they also went further in indicating the values of some of the factors influencing its results. The data from these tests were given by Mr. E. B. Smith, Second Assistant Testing Engineer, U. S. Bureau of Public Roads, in a paper presented at the recent convention of the American Concrete Institute. The following is an abstract of it:

Test Apparatus and Methods

The apparatus used to measure the concrete pressures were cells and gages similar to those described in the proceedings of the American Society for Testing Materials, 1917, page 641, and used for the past few years by this laboratory in measuring earth pressure behind retaining walls and under fills. The instrument consists essentially of an air-tight metal cell having a circular weighing face 10 sq. in. in area. The concrete pressures against the face of the cell are balanced by admitting compressed air to the inside of the cell. When the pressures are balanced, an electrical contact is broken, which extinguishes a light and indicates that the pressure shown on the gage connected with the air pipes is equal to the pressure of the concrete. Tests on these cells show them to be accurate considerably beyond the degree necessary for these tests, and that the movement of the face is less than one ten-thousandth of an inch to break contact, thus making the cell admirably suited for tests on pressures exerted by granular materials, soils, mud and concrete .

Several other experimenters have attempted to obtain such data, but some have been greatly handicapped by not having a suitable apparatus for determining the concrete pressures. Any scheme for determining the pressure values that depends upon a movement of the concrete at the time of making the readings is evidently not reliable. The values desired are the static pressures of concrete against an immovable surface, and not the pressures necessary to stop a moving mass of concrete; to start a movement of the mass before making the pressure readings is also undesirable.

The concrete form used during the laboratory tests was built of 2-in. planks, giving an inside horizontal cross-section of 7.8 by 9.4 in., and a height of 10 ft. Four cells were placed in the form, with the weighing face flush with the inside of the forms. Cell No. 1 was placed in the center of the base and indicated the vertical pressure. Cell No. 2 was set in the center of the rear wall of the form. Cells Nos. 3 and 4 were placed in the center of the right and left side walls of the forms, respectively. The centers of these cells for obtaining the lateral pressure were all 6 in. above the base. Air control pipes leading from all cells were arranged in order, with connections and nipples conveniently located for taking the readings on the four cells very quickly.

The materials for the concrete used in the tests were carefully weighed and mixed by hand. Immediately upon completing the mixing, the concrete was shoveled into buckets and dumped into the top of the forms. The mixing floor and the wood forms were well wetted before the test was begun. The concrete was tamped on top by the use of a long stick having a 2 by 6-in. foot on the lower end. The outside of the forms were also vibrated by striking with a heavy hammer.

The height to which the concrete stood in the column form was then measured, and the pressures on the bottom and three side cells were immediately read and recorded. The batches were varied in size, so that when a new batch was added each 10 minutes, the head of concrete in the form would increase at the rate desired. Readings were taken on the pressure cells immediately after placing the concrete, and again about 5 minutes later, or shortly before placing the next batch of concrete.

The air and mixing water temperatures were recorded each day tests were run. Slump tests of the concrete were made to determine the consistency used in each test, and were recorded as inches slump; or where very wet, as inches diameter of the mass. Fresh batches of concrete were added every 10 minutes, until after the pressures on the cells had passed a maximum, and indicated a decided decrease in pressure. The tabulated data and results of these laboratory tests are shown in Table 1.

Several field tests were run, in addition to the laboratory tests described above, during the construction of a reinforced concrete building at the Arlington Farm. The pressure cells were inserted in the wall and column forms, and pressure readings taken at the time the concrete was being poured. The concrete was machine mixed, raised in an elevator and directed into the forms through a system of chutes. It was then spaded or tamped with a stick having a small blade on the end. The concrete was a 1:2:4 mix, river gravel being used for the coarse aggregate, and the consistency rather sloppy, flowing readily around the steel reinforcing. The results from these field tests conform favorably with those obtained from the laboratory, and are shown in Table 2.

What the Results Indicate

The results shown by these experiments indicate that the fundamental pressure of concrete against the form is about 1 lb. per square inch for the first 1 ft. of head. However, this is by no means all that should be said. A study of the results reported by others, and those obtained from this series of tests show that the following factors have an influence upon the pressure: (1) Rate of filling the forms; (2) cross-sectional area of the forms; (3) consistency of the concrete; (4) amount of cement in the concrete; (5) temperature of the concrete and the time of set of the cement; and (6) character of the fine and the coarse aggregate.

Sufficient data are not yet available to make final statements as to the law by which each of these factors influences the pressure of the concrete against

TABLE I.—RESULTS OF LABORATORY TESTS OF PRESSURES OF CONCRETE AGAINST FORMS.

Mix	Consistency	Temperature degs. Cent., Air	Temperature degs. Cent., Water	Rate of pouring ft. per hr.	Maximum pressure Vert.	Maximum pressure Lat.	Head at max. press., Vert.	Head at max. press., Lat.	Time at max. pres. (mins.) Vert.	Time at max. pres. (mins.) Lat.
1:2¼:3¾	...	23	..	1.5	1.15	.68	2.5	2.0	90	90
1:2¼:3¾	...	26	..	2.7	1.45	.90	3.7	2.5	78	61
1:2¼:3¾	...	..	..	3.3	1.65	.73	3.3	2.5	49	44
1:3:6	Quaky*	19	21	1.63	13.5	.52	2.77	1.70	79	61
1:3:6	Quaky*	15	18	3.32	1.05	.43	4.15	2.53	70	50
1:3:6	Quaky*	19	20	6.72	1.07	.21	6.59	3.80	57	37
1:3:6	Quaky*	17	19	14.26	1.33	.41	10.00	5.12	48	29
1:3:6	Quaky*	17	21	9†	.86	.35	9.28	8.78	10	10
1:3:6	Quaky‡	21	19	1.73	.98	.90	1.71	2.08	36	66
1:3:6	Quaky‡	18	20	3.46	2.02	.85	3.72	3.22	57	57
1:3:6	Quaky‡	16	19	7.08	2.53	1.40	5.50	5.00	49	49
1:2:4	Quaky 14 in. dia	19	18	1.75	2.27	1.50	3.46	2.68	96	86
1:2:4	Quaky 13 in. dia	24	18	3.60	2.35	1.46	4.50	3.40	66	56
1:2:4	Quaky 13 in. dia.	23	23	7.32	1.73	1.21	4.55	4.05	37	37
1:1½:3	Quaky	21	24	1.86	2.75	1.89	3.99	3.49	106	106
1:1½:3	Quaky 12 in. dia.	20	17	3.84	3.49	2.40	4.79	4.29	66	66
1:1½:3	Quaky 13 in. dia.	17	17	7.50	4.60	3.16	7.10	6.60	60	60
1:2:4	Quaky 10½ in. dia. (6½ in. Sl.)	25	18	1.78	1.75	.98	2.09	1.87	46	56
1:2:4	Dry 11½ in. dia. (6½ in. Sl.)	27	18	7.35	2.41	1.93	3.33	2.83	28	28
1:1½:3	Sloppy 12½ in. dia. (3 in. Sl.)	16	15	1.84	2.37	1.17	3.05	2.55	75	75
1:1½:3	Sloppy 15 in. dia. (8½ in. Sl.)	17	15	7.66	3.31	2.05	4.80	4.30	38	38
1:2:4	Sloppy 17 in. dia. (9½ in. Sl.)	18	17	1.86	2.75	1.63	3.38	2.88	85	85
1:2:4	Sloppy 16 in. dia. (9½ in. Sl.)	19	17	7.44	1.97	1.19	3.33	2.83	27	27

*Forms dry. †In one batch. ‡Forms wet.

the form. The results do show that the initial pressure under small heads is equal to the hydrostatic pressure of a liquid having the approximate density or weight of the concrete; that is, approximately 1 lb. per square inch, or 144 lb. per square foot, for the first foot head. As pouring is continued, however, this pressure soon falls below the straight line hydrostatic pressure, and the amount of this deviation depends upon one or more of the factors mentioned above.

It is important to notice that the results prove that if filling is continued indefinitely the lateral pressures near the base of the form finally reach a maximum value and then decrease gradually to zero, regardless of the fact that fresh concrete is continually added above. The vertical pressures are in all cases greater than the lateral pressures; they decrease in value after a maximum has been attained, but not to zero. The total weight of the concrete mass in ordinary construction is not supported entirely upon the bottom of the form, but because of the roughness and friction against the sides, the planking takes part of the weight or vertical pressure. Of course, for wide and shallow masses of concrete, such as floor slabs, the vertical pressure is equal to the weight of the concrete.

A summary of the data at hand seems to lead to the following conclusions regarding the effect of the various influencing factors:

Conclusions Regarding Effect of Various Factors

The maximum pressure exerted upon the forms increases as the rate of filling increases. At a slow rate of about 1 ft. per hour the pressure is, approximately, 1 lb. per square inch, but as the rate increases beyond this value, the pressure increases approximately as the 0.3 power of the rate.

Field tests which were made in places where the distance between the form walls differed, indicate that the maximum pressures obtained increase slightly with the mass of the concrete when the consistency is wet and sloppy. This conclusion, probably, does not hold in the case of dry mixes. Reinforcing just inside the form tends to slightly decrease the pressures, but probably this effect would be neglected in determining the final pressures for use in design.

TABLE II—FIELD TESTS OF PRESSURES OF CONCRETE AGAINST FORMS

All mixes 1:2:4, sloppy consistency.

Temperature degs. Cent., Air	Temperature degs. Cent., Water.	Rate of pouring feet per hour	Distance (inches) cell to opp. side of form	Maximum pressure Lat.	Head at max. pres., Lat.	Time at max. press., (mins.), Lat.
14	13	12.0	8	1.95	3.25	17
..	..	12.0	8	2.45	3.25	17
14	15	20.0	*	2.45	4.62	23
..	..	20.0	18	3.90	4.62	23
23	23	9.0	†	2.2	3.0	20
23	23	12.5	9½	1.85	2.3	11
23	23	10.6	9½	1.45	2.3	13

*3 in. to reinforcing. †18 by 28-in. hole.

The results show in general that the maximum pressure was increased as the consistency of the concrete was made drier within the limit of workability. This is probably different from what might be expected, but the tests show it to be the case. It is probably due to the fact that under the usual conditions of placing dry concrete, it requires more tamping, which, because of its dryness, seems to develop a permanent wedging action between the particles. In the case of wet or sloppy concrete, this wedging action does not exist, as we have approximately a static fluid pressure. For low heads, the dry concrete (when tamped as usual) will give the greater lateral pressure, but for heads of 4 ft. or more and within the time when initial set becomes an influencing factor, the sloppy mixtures give the greater pressure. The average increase of pressure due to the effect of dry mixtures seems to be 0.3 lb. per square inch for each inch decrease in the standard slump test, less than a 5-in. slump.

The richness of the mix also affects the maximum pressures obtained. The richer the mix the greater the maximum pressure, the average increase being 0.12 lb. per square inch for each 1 per cent. increase in the ratio of the cement to the aggregate, beyond 12 per cent.

A decrease in the temperature of the concrete retards the set of the cement, and it is natural to suppose that this is the limiting factor in the maximum pressure obtained, since the pressure increases with the head until the cement takes a sufficient set to begin to support the overlying concrete. Therefore, as the temperature is reduced and the time of the set of the cement is increased, the height of fill may be increased and thus produce or make possible a higher total pressure. Since the cement begins to set and stiffen in about 30 minutes, the maximum pressure is attained under whatever head of concrete may exist at this time. The value for H, the head of concrete, to be used in the formula given below should not be greater than one-half the rate of fill, except where agitation is vigorous and continues in a sloppy mix; then this ratio may be taken up to three-fourths.

Empirical Formula for Pressures

An empirical formula giving the lateral pressures required for use in the design or the investigation of the strength of concrete forms, and taking into account the above numerical factors, is—

$$P = H^{0.2}R^{0.3} + 0.12C - 0.3S,$$

P being the resultant lateral pressure in pounds per square inch; H, the head of concrete fill; R, the rate of fill in feet per hour; C, the per cent. by volume of cement to the combined fine and coarse aggregate; and S, the consistency in inches, or slump,

The vertical pressure is obtained by adding 0.25H to the value of P as found above, except when the inside distance between the vertical sides of the form is greater than one-half the depth of fill; then the value should be taken as equal to the weight of the concrete.

In the practical application of this formula, as with all other formulas, there is abundant opportunity for the exercise of common sense and good judgment. The formula will give pressures somewhat higher than exact values. It shows the effect of continuous and vigorous agitation of the concrete mass only as this is introduced through good judgment in selecting the value for the head of concrete, H. For usual conditions H may be taken as not greater than one-half of R. For ordinary cement in cold weather, or when continuously and well agitated, H may be three-fourths of R when the filling is continuous beyond one hour. A second pouring on top of concrete that has been in place for 45 minutes or more does not add to the pressures already existing at the bottom of the fill.

The values for C may be taken as the next higher whole number in the per cent. of cement by volume, as the required accuracy does not justify fractional numbers, since the slump test is not accurate closer than 1 in.

The value of P obtained by the formula is the lateral pressure against the form at the lowest point of the fill. Since the pressures are not uniform from top to bottom, but vary approximately as the ordinates of a parabola, the center of pressure, or point of resultant pressure, may be taken at 0.6 of the height of fill, H, from the top.

Application of Formula

The following examples may serve to show the use of the above formula:

Example 1.—For reinforced mass concrete. Mix to be 1-3-5; consistency rather sloppy, or 9-in. slump; the rate of fill, R, to be 8 ft. per hour. The total height of concrete filled within one hour, 7 ft. Since this concrete is placed from a chute in a large form, and men are continually walking around in it, the value to be chosen for H is 6, or three-fourths of R. Then, substituting in the formula, P=1.53 lb. per square inch.

The vertical pressure=7 lb. per square inch.

Example 2.—For reinforced concrete column. Mix to 1:2.4 consistency, 8-in. slump; rate of fill to be 24 ft. per hour. Total height of column and final fill, 11 ft., made in one pouring; since this is done in less than 30 minutes, the value for H is 11. Substituting in the formula, P=3.83 lb. per square inch.

Vertical pressure=P+0.25H=6.58 lb. per square inch.

Example 3.—For thin curtain walls and reinforced bulkheads. Mortar mix, 1:5; consistency, 8-in. slump; rate of fill, 20 ft. per hour. Total height of fill in one pouring, 14 ft. The value to be selected for H should be 10, since that is the height of fill to 30 minutes, when the effect of stiffening and set begins. Substituting, we have P= 3.98 lb. per square inch.

Vertical pressure=P+25H=6.39 lb. per square inch.

Example 4.—For dry mix, mass concrete. Mix to be 1:3:6; consistency, 3-in. slump; rate of fill, 6 ft. per hour; distance between sides of form, 3 ft.; total height of fill within 30 minutes, 4 ft. Then P=2.68 lb. per square inch.

Vertical pressure=P+25H=6.39 lb. per square inch.

Stresses in Concrete Roads

Determining the Correct Position of Reinforcement—Each Road on Its Own Merits

It would appear that a good deal of mental confusion arises in considering the question of stresses in a reinforced concrete road. Many people seem to be of opinion that a reinforced concrete slab laid as a road is analogous to a reinforced concrete floor supported by beams or columns. In the latter case they are familiar with the idea of placing the steel near the bottom to take the tensile stresses which occur when the floor deflects under a load, and so they jump to the conclusion that the same principles apply to a concrete road. It is submitted that this conclusion is often very wide of the mark, and to act upon it without due regard to the special considerations of any case in point is unscientific and bad practice.

Undoubtedly the stresses in a concrete road when a heavy load passes over it are very complicated, almost defying analysis, and any deductions obtained by theorising upon them without the assistance of much experimental data (to the best of the writer's knowledge not to hand) can only be taken as a guide to design.

Broadly speaking, there are two types of road to be taken into consideration when discussing this subject, though probably most actual cases will lie somewhere between the two. These are—(1) Where the foundation on which the concrete is placed is already consolidated and sufficiently rigid to bear any load that is likely to be placed upon it. (2) Where the foundation is of a soft and yielding nature. The two cases are put in this order as it is reasonable to suppose that No. 1 will be by far the most common case if (and when) reinforced concrete roads come to be adopted for our main trunk routes.

Stable Foundations

On the majority of our existing main roads there is a coating of consolidated layers of macadam, which may be anything from 9 in. to 30 in. thick. There appears to be no reason why this crust of macadam should be disturbed beyond what may be necessary to rectify the shape of the road. Where a road runs between soil banks and hedges there can be little or no objection to the surface of the new road being a few inches higher than the original. In most cases it will probably be necessary to scarify an inch or two off the central portion of the road, and make up the shoulders with the scarified materials, particularly as existing roads have usually a greater crossfall than would be necessary or desirable in a concrete road. Where this is done the subgrade should be very thoroughly rolled, so that it may be of equal rigidity throughout, and this work should be watched carefully, so that any indications of softness or weakness may be noted and dealt with either by rolling in additional road metal or modifying the design of the reinforced concrete road to meet the case.

Consider now the case of a concrete road laid on a subgrade thoroughly consolidated and capable of withstanding a 12-ton steam roller without sign of softness or weakness. In this case the concrete will form virtually a surfacing layer only, and to adopt the "beam" analogy would be most erroneous. Probably no part of it will ever come into direct tension due to the load.

It is not suggested that on this account no reinforcement is necessary, though some instances are known where concrete roads have been found successful without reinforcement. When a heavy vehicle passes over the road the concrete will be subjected to direct compression combined with impact. As the concrete will often be in a state of internal stress, due to differences in temperature from point to point, the net result will be a complicated system of combined stresses, compounded of compression, shear, &c., which will tend to fracture the concrete into prisms and pyramids, as seen when a block of concrete is crushed in a testing machine. A layer of reinforcement is therefore necessary to distribute these stresses over a larger area, so that the portion immediately under the point of impact may not take all the load and so be stressed beyond its elastic limit. It seems fairly obvious that for this reinforcement to be most effective—or even effective at all—it should be placed as near the upper surface as other considerations will allow.

Yielding Foundations

To consider now the case where the subgrade is of a soft and yielding nature. This will often occur in towns where, as the level of the road is governed by that of the curb, it will be necessary to excavate the road for a depth of 6 in. or more, and so considerably weaken the formation. It would, of course, also apply where a new road or a diversion is laid out in a rural district.

If a heavy load passes over a concrete road laid on a subgrade which is not in itself sufficiently solid to carry the load, deflection will take place to a greater or less extent, depending upon the degree of compressibility of the subgrade. The effect of this deflection will be, of course, to produce tensile stresses on the under surface of the concrete demanding bottom reinforcement. But it must not be overlooked that, as the road is monolithic, and reinforced concrete an elastic material, the effect of deflection immediately under the load will be to induce a reversal of curvature in the surrounding concrete which is not acted upon by the load. This will set up negative moments with tensile stresses in the upper fibres of the slab, demanding top reinforcement. It may be noted in passing that the effect of heavy loads continually traversing such a road will be to produce a form of wave movement in the concrete, which, though not sufficient to be observed directly, will produce constant alternation of the stresses in the concrete and steel. The effect of this, and the possibility of fatigue in the materials should not be lost sight of by engineers.

There is also the question of a soft spot in an otherwise solid subgrade, such as a recently filled-in excavation. Any such spot should receive careful consideration, as it is well known that settlement may take place in an old sewer-trench, for example, months, and even years, after it has been filled in, and quite apart from any load that may be imposed upon it. The effect of such an occurrence under a concrete road would possibly be more serious than if the whole foundation was of a uniformly yielding character. The concrete slab would become suspended between the solid sides of the trench, and not only would tension be set up in the lower fibres, but severe shear stresses would occur, demanding vertical or diagonal reinforcement.

Temperature Effects

Lastly, to consider the effect of differences of temperature in the concrete. It is now generally conceded, as a result of experimental roads, that to provide for expansion and contraction by means of transverse joints is not good practice, and that it is better to distribute the temperature stresses by means of reinforcement. Concrete is not a good conductor of heat, and it is therefore reasonable to suppose that the variations of temperature will be much greater at the upper than at the lower surface, particularly when such variations occur at short intervals. Probably the severest test that a road would be sujected to would occur during fine weather in September or October, when we often experience a very hot sunshine at midday and a frost at night. In such a case the upper surface would have a very considerable range of temperature in twenty-four hours, whereas the lower surface, being in contact with the ground, would probably vary but little.

From these considerations it is clear that for the reinforcement to be effective in withstanding the temperature stresses, it should be placed near the upper surface.

Conclusions

(1) A layer of reinforcement is desirable near the upper surface of the concrete.

(2) Where lower reinforcement is necessary it is ineffective unless upper reinforcement is also used.

(3) Every yard of reinforced concrete road should be taken on its own merits. No man who calls himself an engineer should adopt any system of reinforcement regardless of the particular requirements of the spot where the road is to be laid, merely because the individual who is selling him the steel tells him he ought to do so.—"Highwayman" in the Surveyor.

The statement of P. Lyall & Sons' Construction Co., Ltd., Montreal, for the year ending March 31st shows gross earnings of $377,734, and after paying bond interest, preferred and common dividends, sinking fund bond redemption, $36,070 is carried forward. The company has been fortunate in securing several large contracts in addition to those already in hand.

La Compagnie de Tuyax de Drainage, Ltd., has been incorporated with a capital of $99,000 to carry on business as manufacturers and dealers in clay, drain, earthen and concrete pipes, artificial stone and all building material. The head office is at L'Islet Station, P. Q.

An examination for admission to study of architecture or registration in the Province of Quebec will be held on the 26th July, 1920, and the following days, in the rooms of the Province of Quebec Association of Architects, City Hall, Quebec, at 9 o'clock each day.

Modern Developments in Water Supply

Storage and Algal Troubles—Chlorination—Excess Lime Method —Removal of Taste—Alum Recovery in Filter Operation

By Capt. A. F. Girvan*

THE war has taught us lessons with regard to many subjects, and one of these is that of water supply. Shortage of fuel and labor encouraged experiments, with the object of minimizing the effect of these deficiencies in the case of civil concerns, and a number of small towns sprang into being for the manufacture of munitions on sites with wholly inadequate water supplies for the needs of the suddenly increased or entirely new population, and raised the problem of rapidly dealing with the situation, while the vast concentrations of men and animals in the various theatres of war necessitated the obtaining of adequate supplies of pure water from bad or indifferent sources.

Sir Alexander Houston had demonstrated the marked beneficial effect of storage, but against these advantages of storage we have to set the fact that at certain seasons there may be a development of algae in the water. In order to guard against trouble of this kind in the case of the London supply, micro-photographs are taken at least once a week. A definite amount of each stored water is centrifugalized, and the sediment which is thrown down is transferred to a cell on a microscopic slide, and a photograph is taken under standard conditions. These photographs examined week by week show not only the sorts of algae which are present, but also their number, and whether they are increasing in quantity.

Combating Algal Troubles

It has been found that copper sulphate in very small doses is efficacious in preventing or restricting growth of algae or in killing a growth which has already developed, but it is probably undesirable to use it unless it is urgently necessary, as it is sometimes found that, although one kills off the particular algae which are the cause of the immediate trouble, others of a different kind may develop still more rapidly, and the final trouble may be worse than the first.

The copper sulphate appears sometimes to upset the balance of Nature and to produce unexpected results. It may perhaps be well to add that no copper can be detected in the filtered water by delicate chemical tests.

Up to a few years ago the occurrence of a taste in the water supply was almost the first indication of the presence of algae in the stored water in undesirable quantity. The reservoirs were then sometimes treated with a dose of copper sulphate of about one quart per million. This killed off most of the growth, but the dead organisms continued to pass on to the filters and to choke them rapidly for some time afterwards. The expense of cleaning the beds frequently is very considerable, and the maintenance of an adequate supply of water is rendered difficult owing to the number of beds which may be out of action at the same time. But the study of the photographs enables one to act in advance in various ways. For instance, the engineers in charge of filtration may be warned to have the filter beds cleaned at the first sign of choking, and to arrange that all are in a fresh state, or the reservoir may be dosed with copper sulphate to prevent algal growth reaching a serious amount. Another method of anticipating filtration troubles is by the "resistance to filtration" test devised by Sir Alexander Houston. It is very simple. A piece of fine linen is tied over the end of a glass tube a few millimetres in diameter; 100 c.c. of raw or stored water is filtered through this and then tap water from a constant level cistern is run through the now partially clogged cloth. The volume of tap water which runs through in a definite time is a measure of the filtering qualities of the raw or stored water. If algae or other solids are too abundant, the cloth gets clogged and little water passes. The method is more sensitive than the filter beds themselves, so that the engineers can be warned in ample time. This method usefully supplements the photographic one.

It is rare for the stored waters themselves to develop any marked algal taste. Any slight taste is usually removed by a sand filter in good and reasonably fresh condition. The taste appears to become marked only in the filtered water, when there is a thick deposit of algae on the sand of the filter, and then only under certain abnormal conditions. The removal of this skin, which may be nearly half an inch thick sometimes, in the usual course of cleaning, will restore the bed to its usual good state of delivering water with no unpleasant taste. If an algal taste has developed in the filtered water, it can be removed almost instantly by the addition of a permanganate.

Chlorination

There are circumstances when it may be desirable to dispense with storage as a means of purification and to sterilize the water by chemical means. There are a few sterilizing agents which have been found practicable on the large scale, and of these chlorine is by far the most important, though in the case of soft waters the excess lime method devised by Sir Alexander Houston has certain advantages.

There are two principal ways of chlorinating water; one is by adding bleaching powder solution, and the other is by means of gaseous chlorine.

In this Thames treatment the former is used. The plant is really quite simple. Briefly described, it consists of a pair of mixing tanks, each of about 150 gallons capacity, and a pair of solution-containing tanks, holding 900 gallons each. The latter tanks are connected to a small cistern fitted with a ball-cock arranged so as to keep the solution in it at constant level, and the small cistern discharges through a tap into the river-water intake. All the tanks, piping and fittings are coated with a tarry preparation called "bitumastic," which is quite effective in preventing corrosion. A weighed amount of bleaching powder is put into one of the mixing tanks, and is stirred up with water and allowed to settle, when the clear solution of calcium hypochlorite is run off into one of the solution-containing tanks. This is repeated several times until the latter tank is full. The strength of the solution is then determined by titration with thiosulphate, and the rate of its discharge into the river-water intake is adjusted from this figure and from the volume of water going into supply. The quantities dealt with are considerable. The volume of Thames water treated per annum is about 22,000 million gallons, and this involves the use of about 100 to 150 tons of bleaching powder. The method of using gaseous chlorine instead of bleaching powder is growing in popularity. There are several types of apparatus in use, each of them covered by patents by various firms. The function of all of them is automatically to deliver a pre-arranged dose of chlorine from the cylinders in which the liquid chlorine is purchased into the water to be treated.

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*Read before Institute of Sanitary Engineers (British).

In all cases it is desirable not to run the chlorine direct into the water under treatment, but to make a solution of it by passing the gas through a tower in which water is flowing, and to add this solution. This method ensures better mixing and no excessive local concentration.

Relative Merits of Bleaching Powder and Chlorine Gas

As regards the relative efficiency of bleaching powder and chlorine gas, there was at first some divergence of opinion. As is frequently the case with anything new, the advocates of the use of chlorine gas claimed too much and exaggerated its relative value, but it may now be taken as established from experiments by the Water Board, by Avery, in Canada, and by others that if a normal water supply be treated with the same amount of available chlorine, whether derived from bleaching powder or liquid chlorine, and provided that proper mixing takes places, the sterilization in either case will be the same. As regards practical and mechanical details, each method has its merits and demerits. Bleaching powder is bulky and unpleasant to handle, the storage of large quantities takes up a lot of room, and considerable labor is needed in preparing the solution and dealing with the sludge, while the strength of the solution has to be determined every time a tankful is prepared, and the rate of discharge varied accordingly. On the other hand, the apparatus is simple and straightforward, and there is little to go wrong with it.

The chlorine gas plant is much more compact, and the spare cylinders occupy little space, but it is rather complicated and less easily understood by the average man who has to work it, while there are various valves, regulators and unions which are apt to leak. A leak of chlorine is dangerous, and it has been found necessary to have gas masks or respirators at hand for the men in charge of the plant. In cold weather it is necessary to warm the chlorine cylinders, as the evaporation of the liquid chlorine chills them to such an extent that the flow of gas falls off seriously. When in good order, however, the plant can be left twelve hours or more without any attention, and this cannot be said for the bleaching powder plant, where the flow is apt to diminish owing to choking of the tap which regulates it.

New River Methods

The New River has been chlorinated by means of chlorine gas at intervals during the last year or so.

The reasons for employing sterilization in this case are different from those which governed the treatment of the Thames water. There, the chief object was to save coal and pumping costs while giving at least as good a water as usual. In the case of the New River, however, the conditions are very different. The storage reservoirs are inadequately large, holding only about four days' supply, and, in addition, the rate of filtration is about double that practised at the other works of the Metropolitan Water Board. On the average, owing to the fact that a large amount of pure deep-well water is pumped into it, the New River yields a filtered water which is exceedingly good, but when floods occur in the Lea Valley the water deteriorates greatly, both before and after filtration. The only remedy available in the past would have been to construct enormous storage reservoirs at a prohibitive cost, but chorination in time of floods appeared to be a much cheaper alternative if it were successful, and it was therefore given a trial. The results were quite successful, except in one particular, and that was with regard to taste. It is very difficult to avoid giving the New River water a taste even when it is treated in the same way as the Thames water where no taste trouble caused by chlorination has ever been experienced. No explanation is forthcoming as to the reason for this. Various waters have been examined in the laboratory, and some give tastes very readily, while others are comparatively immune. On the whole, it seems perhaps that the purest waters are the most troublesome, but water from the same source behaves very differently at different times, and its behaviour cannot at present be foreseen.

Increase of Chlorine Removes Taste

The dose of chlorine is regulated partly according to the bacteriological results in the laboratory, but as these cannot be known for several days after taking the samples they cannot serve as an exact guide. It has been found best in this New River treatment to give a relatively high dose of chlorine, followed some hours later—that is, further down the river—by a dose of sulphur dioxide to remove the excess of chlorine which still remains. Until this winter, however, this treatment could be continued only for about two or three weeks before taste troubles began, and then consumers complained, and the treatment had to stop. But this season it has gone on continuously for about nine weeks without any tasting water reaching a consumer. This is the result of numerous experiments by Sir Alexander Houston, who has discovered two ways of avoiding or getting rid of the taste. The first is a very remarkable one. It is simply to increase the dose of chlorine. Suppose half a part of chlorine per million is the desired dose and that a taste develops with this dose, then increasing the chlorine to, say, one part per million will probably give a normal tasting water. Of course, the dose of dechlorinating agent further down the river has also to be increased. In the laboratory the addition of chlorine has actually removed a taste already caused by chlorination.

The second method is a very recently discovered one and is, I think, of very great importance but little has yet been published on it. This method is to add a permanganate to the chlorinated water. The waters which have been experimented with up to the present have been chlorinated in such a way as to yield a taste, and then the addition of potassium permanganate or sodium manganate has removed the taste very rapidly. This has been done both in the laboratory and on the large scale, in the latter case about 30,000,000 gallons a day being dealt with. The dose that has been found effective in the case of the New River varies from about 2 lb. to 8 lb. of potassium permanganate per million gallons.

It is too early yet to say whether the method will be successful in all cases; but it will be of great use even if it is only sometimes effective. I suppose that every man who has been on active service associates a chlorinated water with a horrible taste. This taste was sometimes unavoidable even with the most skilled attention; but if this permanganate treatment had then been discovered I think it is probable that chlorinated water would have failed to call up such evil memories as is actually the case. The treatment is certain to be tried all over the world where chlorination is done on a large scale, and if the results are as good as seems likely, the whole community will owe a great debt of gratitude to Sir Alexander Houston for this discovery.

Excess Lime Method

There remains the excess lime method of sterilization to be considered. This consists in adding sufficient lime to the water under treatment to soften it and to leave a slight excess of free lime. The excess of lime has a strong bactericidal effect and there is no possibility of producing a taste. In the case of a soft water the method is economical, but a hard water requires so much lime to soften it that the cost is probably too great to be practicable.

This method has been used successfully on the large scale at Aberdeen and at Accra, in West Africa.

At Aberdeen, where the water from the river Dee is very soft, the water was given a dose of 1 part of CaO for 100,000 parts of water, followed by seven days' storage and then filtration at about the usual rate. The cost of the lime was about a shilling per million gallons, and the saving in capital expenditure compared with alternative schemes was about £100,000.

At Accra it was necessary to have two large reservoirs for purposes of quantity. The source was polluted and at the prevailing temperature of 80 deg. F. the water developed heavy algal growths and a very bad taste. Simpson and Houston advised treatment at the intakes with lime, leaving an excess of 6 parts CaO per 100,000. The reservoirs were used alternately, as it took about three weeks for the excess lime to be neutralized by the carbon dioxide in the atmosphere. The result was entirely successful, the water after the treatment being pure bacteriologically and free from taste, while the algal growth was stopped. This is the first case in which lime has been used for the double purpose of giving a sterile water and of arresting algal or plankton growth. In cases where it is not possible to store the treated water long enough for the excess lime to be neutralized by the atmosphere, it is desirable to neutralize the excess after a suitable time of contact by adding alum or mixing the water with a suitable proportion off unlimed but stored or chlorinated water from the same source.

There is one point common to all sterilization processes, and that is the influence of the time of contact of the sterilizing agent with the water. It is of the greatest importance to allow the sterilizing agent sufficient time in which to act. The following figures illustrate this point in the case of chlorine acting on raw Thames water:—

Dose of Chlorine.	Time of contact.	Percentage of samples in which B. Coli was killed (60 experiments in each case).
1 in 1 million	1 hour	32
	5 hours	97
1 in 1½ million	1 hour	13
	5 hours	88
1 in 2 millions	1 hour	1.7
	5 hours	66

In cold weather 24 hours' contact or longer is necessary if a small dose of chlorine is to be effective.

Similar results are obtained in the case of lime. For example, the following figures were obtained with raw Thames water:—

Dose of lime in excess of that required to soften the water.	Time of contact.	Remarks.
7 parts per 100,000	1 hour	B. Coli alive in 93 per cent. of experiments
	5 hours	B. Coli dead in 79 per cent. of experiments
	24 hours	B. Coli dead in 98 per cent. of experiments

Filter Processes

Passing now to the question of filters. The ordinary slow sand filters occupy a great deal of space, about an acre per million gallons per 24 hours. They also require a lot of labor for cleaning purposes, and therefore so-called mechanical filters have been introduced for doing the same work in a much smaller space. The ordinary slow filter delivers from one to two gallons per square foot per hour, but mechanical filters work up to rates of about 100 gallons per square foot per hour. There are many types of mechanical filters, and new ones are frequently being designed. Generally speaking, they consist of iron or ferro-concrete receptacles with a layer or layers of sand inside through which the water is forced at considerable pressure. It is generally necessary to form an artificial skin in the sand by adding a coagulant to the water. Alum is generally used for the purpose—it reacts with the calcium carbonate or bicarbonate in the water and forms a gelatinous precipitate of aluminium hydroxide which deposits on the surface of the sand and which is capable of holding back most of the bacteria. Owing to the large volume of water which mechanical filters treat relatively to their filtering area they block quickly and have to be cleaned often, say once or twice a day. The various methods of cleaning the sand in these filters are the chief points of difference between the various types. The general principle is to force water from another filter through the sand in the reverse direction, meanwhile agitating the sand by mechanical devices. The operation only takes a few minutes, and requires no labor except turning a few taps. It is not possible to go into further details in a paper of this nature. Improvements are being made, and the present high cost of labor may give further impetus to the development and use of such filters. Munition work has already done much in encouraging their use in "mushroom" towns and other places where the demand for water has suddenly increased. At Gretna, for example, a supply of 10,000,000 gallons a day was needed. The river Esk, which was the source of water, was polluted by sewage. Mechanical filters were installed, but did not at first give us a thoroughly safe water from the bacteriological point of view; but after chlorination the results were completely satisfactory.

One of the obstacles in the path of the general adoption of mechanical filters has been the cost of the alum or other coagulant, and of the settling tanks which are desirable if the best result is to be obtained. A recent patent has been taken out to recover the alum, but the process has not yet, I believe, passed the laboratory stage. If this should prove effective and cheap, it will be a considerable incentive to the use of these filters. Another promising line of development is undergoing investigation by the Metropolitan Water Board. This is to pass a raw or stored water at a high rate through mechanical filters without the use of coagulants, and to subject the water to chlorination either before or after filtration. Algae and other relatively large bodies and a proportion of the bacteria are retained by the sand and the remaining bacteria are dealt with by the chlorine. It is too early yet to say, however, what success will be obtained. Mechanical filters have a number of desirable features which are not shared by the ordinary slow filter. The filtering material is not touched by hand in the process of cleaning, whereas the laborers have to walk about on the surface of the ordinary type during this process. Mechanical filters are generally completely enclosed and are immune to weather troubles, whereas the slow filters cannot be cleaned in time of hard frost or snow. The former are generally quite free from any possibility of contamination by infiltration, as they are usually constructed entirely above the ground level, but it is practically impossible to be certain that an open sand filter bed is in a watertight condition and is not receiving impure water from its underground surroundings. It has yet, however, to be proved convincingly that mechanical filters will uniformly yield water bacteriologically equal to or better than that produced by the slow filters; but it is hoped that the newer developments may achieve this desirable result.

Making Dwelling Construction Fireproof

Discussion of Defective Construction in Houses and its Relation to Fire Hazard—Carelessness Rampant

THE homes of this continent—usually models of convenience and comfort—have been developed with little thought or consideration as to the fire hazards or the means of safe-guarding lives and property against the ravages of fire. We have made wonderful progress along other lines tending toward conservation of natural resources, not excepting conservation of life, yet today the majority of houses are built to burn—not to endure.

For a number of years past the annual fire loss has represented an amazing and needless waste—loss of life, employment, property and natural resources. In all too many cases, when a fire once starts in a home, the building is soon transformed into a smoking ruin, indicating a serious defect characteristic of modern construction. While much of this loss is traceable to household carelessness other prolific causes such as over-heated furnaces, defective chimneys and flues, and the like are related to the construction of the house. Attention to these features as well as those designed to prevent the spread of fire within the dwelling would go far toward reducing the vast annual loss to the householders of this continent.

As a guide to the better protection of lives and homes against fire, a committee recommended to the National Conference on Concrete House Construction the Code of Suggestions for Construction and Fire Protection, issued by the National Board of Fire Underwriters. The data and suggestions contained in this code which relate to the construction of concrete dwellings have been freely used by this committee in the preparation of its report which is reprinted in part herewith. We quote in part from Section 2, Part 1 under "Dwelling Construction Under Slight Control," as bearing on the importance of this subject and the need for legislation and standards, governing the construction of dwellings:

Little Restriction On Construction

"Municipal building codes place little restriction upon the construction of dwellings. Within the fire limits which commonly comprise a small congested portion of a city's area, frame dwellings are usually excluded; wooden shingle roofs prohibited; regulations regarding chimneys, heating appliances and lighting are enforced and in most codes some provisions for fire-stopping walls and partitions are made, but not sufficiently explicit usually to be of much real service. Outside the fire limits any type of construction is permitted and the enforcement of other regulations is generally lax.

"Beyond the boundary lines of cities and towns which have building ordinances there are hundreds of suburban real estate developments and villages which have little or no building regulations and also vast numbers of dwellings scattered through the country which are under no restrictions whatever. Every builder is a law unto himself.

Reasons Why Dwellings Burn Freely and the Remedy

"The proportion of dwellings which catch fire and are a total loss, or which have building and contents ruined, is very high. The reasons are plain. First, in cities such buildings are usually located in outer areas more or less remote from fire fighting apparatus. Many are situated outside of city limits or in villages or suburban developments where fire protection appliances are meager and unreliable. Second, dwellings are generally small and low so that a fire well started before discovery is likely to envelop all portions before outside assistance can become effective. Third, the majority of dwellings are of very combustible construction with open stairways lined with varnished or painted woodwork connecting all stories and with no provisions for arresting the spread of fire from floor to floor or from room to room. The cellar where the heating appliance is usually located often contains much combustible material, a combination which is dangerous. Moreover, the cellar is more or less directly connected by open channels with all parts of the house including the garret. This results from lack of proper protection around water, gas and steam pipes, hot air pipes, dumb waiter shafts and open space through walls and partitions. Fourth, the nature of the occupancy is such that much of the time there are not enough able bodied occupants present to do effective fire fighting from within.

"These four conditions combined result in the enormous property fire loss and the sacrifice of many lives. The lamentable feature of the situation is that a large part of this loss could be prevented by reasonable precautions in construction and careful observance of the ordinary rules of fire protection. The cost of the former would be comparatively small, the only expenditure for the latter would be a little thoughtful vigilance."

Recommendations

The following recommendations, among those made by the Bureau of Standards (Circular No. 75—safety for the Household) all have a more or less bearing on the fire hazard and should receive due consideration when selecting or building a home.

All steam, water, gas, and hot-air pipes should be properly located and installed.

The heating arrangements, including furnaces, boilers and stoves, should be isolated, and protective measures should be adopted to prevent fire originating at such devices from being quickly communicated to the remainder of the building.

The electric and gas installations should be carefully installed and inspected so as to minimize danger from defective wires, unsuitable switches, outlets, and sockets, leaky pipes and burners, and other defective devices.

Suitable safeguards should be provided against the dangers from heating devices and open flames to be used about the premises.

Suitable fire stops should be provided in the construction of the walls to insure against rapid spread of fire. Continuous air spaces under floors and in walls, which permit fire to smolder for a long time, often without being noticed should be avoided.

Windows, doors and other external openings should be protected against fire from near-by windows in the adjacent building or from opposite windows in the same building. Wire glass often affords an excellent means of protection where such exposure exists.

Roof construction, which provides an inflammable place for fire brands from outside fires to alight, should be avoided.

Wooden lath on thin joists, a construction which burns through rapidly, should be avoided.

The use of wooden and other inflammable materials about chimneys should be reduced to a minimum, and continuous vertical air spaces should be eliminated by means of incombustible fire stops.

Woodwork surrounding hot-air pipes, flues and registers should be properly protected by incombustible material.

Methods of Securing Maximum Fire Protection

The committee in considering the question of fire protection and insurance has endeavored to offer recommendations that will provide for a safe, practical and conservative construction, readily adapted to dwellings of concrete. That real fire-resistive construction is the exception rather than the rule is due largely to a mistaken idea of the cost that building fire-safe involves.

The National Board of Fire Underwriters classify dwellings into four types according to construction; the first three types are peculiary adapted to the employment of concrete:

Type 1. Buildings fully protected properly called "fireproof" in which all structural parts, including doors, windows and trim are of incombustible construction. Some buildings which belong in this class have minor doors and windows of combustible material, but where these do not serve as important cut-offs, or are not likely to be subject to serious fire exposure, their presence in the building would probably not materially increase the hazard.

Type 2. Buildings with partial protection; commonly (though improperly) called "fireproof." The term "semi-fireproof" would properly be applicable. Such buildings have walls, floors, roofs and partitions of incombustible construction, but with wooden floor finish, wooden trim, and ordinary doors and windows.

Type 3. Buildings with walls of incombustible construction, but having all interior construction, including the roof, of wood; the roof covering either being of wooden shingles or some type of fire-resistive material.

Type 4. Buildings constructed entirely of wood either with or without fire-resistive roof covering. Sometimes the walls are veneered with brick, or covered with stucco.

Type 1 buildings are in a sense idealistic, although an increasing number is being erected each year. The National Board of Fire Underwriters refer to buildings of Type 2 as follows: "They are not subject to spread of fire through concealed spaces which is the worst constructional defect in dwellings; nevertheless, they are liable to destruction due to fire communicating from one portion of the house to another through open stairways, aided by the free use of wooden trim, doors and windows. Many houses of this type have been built in late years. With a little thoughtful care in the design of such buildings, and the exercise of prudence in selecting materials for trim, particularly where they are used in the planes of fire barriers, this class of residences can be made exceedingly safe. There are several methods of constructing non-combustible dwellings of this type which cost but little more than a frame building."

Concrete For Fire-Safeness

There are a number of ways in which concrete can be used to obtain varying degrees of fire-safeness, secured by types 1 and 2. Briefly there are four systems suitable for concrete dwelling construction recommended by the committee as falling under these headings:

A. Walls, partitions, floors and roof of monolithic concrete construction, reinforced where and as necessary.

B. So-called "unit systems" which mean that precast slabs supported by pilasters of concrete precast or cast in place, constitute the walls, floors, roof and partitions. Walls, partitions, floors and roof may be solid or hollow.

C. Walls of concrete block, tile or similar units, with partitions of metal studding and lath or all hollow concrete tile, or other incombustible material, covered with plaster. Floors and roof may be solid or reinforced concrete or may have metal joists covered by thin reinforced concrete slabs, concrete tile or cement asbestos shingles or other approved covering. Walls, floors, partitions and roof may be solid or hollow.

D. A metal frame resembling that used in a house built of wood, to which metal lath or fabric is fastened and the exterior covered with portland cement stucco. Metal lath may be fastened to this frame on the interior which is plastered with ordinary plaster. Partitions may be of metal frame and lath like the exterior walls or of hollow concrete tile or other incombustible partition material. Floors and roof may be solid slabs of reinforced concrete or may have metal joists covered by thin reinforced concrete slabs or other approved covering. Metal lath is attached underneath the joists, then plastered.

Roof Covering Has Important Effect

The relative security of Type 3 buildings depends in considerable measure on the character of the roof covering. Combustible roof coverings, especially wood shingles constitute an important fire hazard. The extent of the damage to the building would be much greater in case of a fire getting beyond control in such a building than in buildings of Types 1 and 2. These statements apply with equal force to buildings of Type 4, but there is the additional hazard due to the flue spaces between the wall studding through which a fire originating in the basement or attic can sweep with incredible rapidity. This hazard can be almost entirely eliminated by fire-stopping the walls, but unfortunately efficient fire-stopping has not come into general practice. In respect to the danger from exposure to fires in neighboring buildings, the house covered with portland cement stucco particularly on metal lath or fabric has an obvious advantage over the house with wood weather boarding, especially if incombustible roof covering is used in both cases.

Supplementing the instructions for the reduction of fire hazards given previously, the committee makes additional recommendations, applying particularly to the reduction in the fire hazard in Type 3 houses.

Construction Detail, Walls and Partitions

Substantial walls are of great structural importance in every dwelling. They must not only render satisfactory service as regards carrying capacity and resistance to weather, but they should also be efficient in case of fire, which means that they shall be substantial enough to withstand the expansion stresses resulting from continued severe heat. "It is poor economy to skimp footings. If they are insufficient for the load they carry settlement is sure to come in time, producing ugly wall cracks, misfitting doors, openings which will let in ground water and other defects, which plague the occupants as long as the house exists. The settlement of foundations is also liable to produce chimney cracks, and so causes a fire hazard."

Partitions of concrete units or of metal lath and portland cement mortar are to be preferred for types 1 and 2 previously mentioned and also for bearing partitions in the other types.

Floors

The National Board of Fire Underwriters make the following recommendation regarding the importance of constructing a horizontal cut-off for cellars:

"As the heating equipment of most dwellings is located in the cellar or basement, where subject only to occasional supervision; and as that space is also usually a storeroom for fuel and all sorts of combustible material, the chances of a fire are evident. The remedy is to confine such fires at the place of origin by a cut-off between the cellar and the storey above by making the separate floor as fire resistive as possible, consistent with the type of construction and to properly protect all openings to same as herein provided.

"The best possible cut-off is a fire-proof floor. Such floors are a requisite for dwellings of Types 1 and 2. They are equally applicable to dwellings of Type 3. They should be used wherever possible for they constitute a distinct safeguard.

"In buildings where steel beams are not otherwise used, it is probable that some variety of concrete floor construction would be the simplest and most economical. The forms could be easily supported; no hoisting on concrete would be necessary and as the floor would be laid before the rest of the building was erected, all the form lumber could be used again for other purposes. In order to reduce the span and thickness of the floor slab and thereby lessen the expense, the floor could be divided into panels by having beam supports at one or more intervals.

"In dwellings of Type 3 where it may be impossible to secure a high degree of perfection afforded by a fire-proof floor for a cellar cut-off, it is still very essential that efficient temporary protection be provided and that every precaution be taken to prevent a cellar fire spreading to floors above, at least long enough to afford reasonable time to subdue it. This can be accomplished by protecting all communicating openings as elsewhere provided, and by covering the ceiling with fire-resistive material."

The best results in ceiling covering, when the floor is not concrete will be obtained by the use of portland cement plaster on metal lath.

Roofs

The same Bulletin contains the following regarding approved roofing:

1. "Wherever possible use the fire-resistive roof covering. The safety which it offers is well worth the additional expense." Among the recommended roofings may be included monolithic reinforced concrete, concrete roofing tile and cement asbestos shingles.

2. "The fire resistance of ordinary roofs can be considerably increased by covering the rafters on the under side with metal lath and plaster, asbestos mill board, or asbestos building lumber, gypsum plaster board or any other incombustible heat insulating material. Such coverings add much to the comfort of a house by making the attic cooler in summer and warmer in winter. The insulation can be further improved by a two-inch layer of mineral wool placed between the rafters and supported by any of the board materials above mentioned.

Wooden Shingle Roofing

"The great danger of the wooden shingle roof is from chimney sparks or flying brands from burning buildings. Wooden shingle roofs in combination with chimneys, defective or otherwise, have probably been accountable for more dwelling house fires than any other defect in construction or equipment. Records show that they are responsible for over twenty per cent. of all fire losses in dwellings. The wooden shingle has also been justly called a "conflagration breeder" for experience has shown that many of our large conflagrations have been spread and rendered uncontrollable by the flying brand hazard of this material.

Chimneys, Flues, Smoke Pipes and Fire Places

The Bureau of Standards circular No. 75 has the following to say regarding chimneys and flues: "One of the serious fire hazards is that due to defective chimneys and flues. Good construction will minimize this hazard and will render the formation of cracks later, due to vibration, loading, settling or expansion and contraction, less likely."

The National Board of Fire Underwriters make the following recommendation regarding the use of portland cement mortar: "Portland cement mortar only should be used in the construction of chimneys and flues. Portland cement mortar is very superior to lime mortar in resisting the action of heat and flue gases. The latter disintegrates in time and is liable to fall out of the joints, thus producing a hole through which a fire is likely to originate."

Dwelling house chimneys should have walls at least four inches thick and be lined with a suitable flue lining. In monolithic concrete chimneys, this flue lining will serve as an inside form. If chimneys are not lined they should be not less than eight inches thick. It is recommended, however, that lined chimneys of such thickness be used in localities subject to severe winters and where continuous hot fires are a necessity. A concrete chimney should be reinforced in both directions, otherwise it is liable to crack through temperature stresses or unequal settlement of foundation.

Not more than two flues should be permitted in the same chimney space, and the joints of the two sets of flue linings should be offset at least six inches. The joints in the inside of all chimneys and flues should be struck smooth.

All chimneys should be built from the ground up and all of their weight should be carried by their proper foundations. Foundations for exterior chimneys should be started well below the frost line. Connection between chimney and roof should be made with sheet metal flashing arranged to overlap and allow for movement that may occur between chimney and roof.

"No wooden beams or joists shall be placed within two inches of the outside face of a chimney or flue, whether the same be for smoke, air or any other purpose. No woodwork shall be within four inches of back face of the wall of any fireplace. All spaces between the chimney and wooden beams shall be filled with some porous incombustible material such as mineral wool cinders, etc., this material to be supported by metal set into chimney and nailed to the wooden beams or flat metal nailed to the woodwork with the inner edge close to the chimney."

Smokepipes are almost as important in point of installation and maintenance as chimneys because of the danger of fires from defective smokepipes. They should always enter the chimney horizontally and the connection through the chimney wall to the flue made with round tile or metal thimbles set in portland cement mortar. In monolithic concrete chimneys the connection should be cast with the chimney. Close flue holes when not in use with tight fitting metal covers.

No smokepipe should be within nine inches of any woodwork, and where wood or coal are used as fuel it is better to provide a greater distance. Smokepipes should not be permitted to pass through floors, nor through closets or other concealed spaces, nor through a roof having wooden framework or covering, nor should such a pipe enter a chimney in the attic or garret. Every smokepipe should be cleaned at least once a year.

The construction of fireplaces is important, particularly the thickness (never less than eight inches) and lining should be of fire brick. Trimmer arches supporting the hearth should be of reinforced concrete not less than four inches thick.

Heating and Lighting Equipment

Many of the fires in dwellings are started through improper protection of the heating and lighting equipment. The recommendations of the National Board of Fire Underwriters covering heating and lighting equipment, the code of suggestions already referred to should be followed out as they may apply in the construction of houses of the various types that have been described.

The committee recommends that in dwellings of a character to warrant the additional expense, all heating, ventilation or other service equipment should be separated from other portions of the building by a five inch concrete wall; the ceiling also should be of portland cement plaster on a metal lath base.

Fire Stops

"No one feature of house construction will contribute more to its safety in case of fire than efficient, well placed fire stops. Their purpose is to delay the spread of fire and so assist in confining it to the storey in which it starts. This protects life and affords a better chance of extinguishing the fire."

Fire stops are applicable principally to non-fireproof buildings though they can be used advantageously in any type of building where openings exist that would act as flues to distribute heated air or gases from a fire in one part of the building.

Dwellings within ten feet of non-fireproof buildings should have the walls behind eaves or cornices fully firestopped to prevent fire from a nearby building breaking through into the attic space. This also protects against fire which might lap up under the eaves through the windows.

Incombustible cornices should be used. If impossible, metal lath and portland cement plaster or stucco should be used on underside of cornices.

Space between stair carriages should be stopped by a header beam at top and bottom. Where a stair run is not all in one room, or where a closet is located under the stairs, the stair carriages should have an intermediate fire stop, and the under side should be covered with portland cement plaster on metal lath.

Ducts, chases, or shafts for pipes, wires, speaking tubes, and similar details, should be firestopped at each floor with mortar to form tight joints. All exposed pipes passing through any floor or wall should have the surrounding air space closed off at the ceiling and floor lines.

Contract Provisions Proposed by Associated General Contractors

(Continued from page 494)

the quantities are increased over the estimate by more than a certain fixed per cent.

16. Arbitration

In no case should the engineer or architect be made the final judge as to the interpretation of the drawings and specifications or the performance of the contract. All decisions and interpretations should be subject to prompt arbitration at the choice of either party to the dispute.

Granules of granite have been mixed with lime, moulded and hardened under steam pressure to make bricks which are said to be of excellent quality for structural purposes.

Hints for the Contractor

That May Save Him Time and Money—We Will Pay for All Accepted Items—Send One In

Experiments to Determine Stop Log Lifting Power at Kipawa Dam

By A. Langlois, B.A.Sc., C.E.

SOME time ago, some experiments were carried out at the Department of Public Works' dam at Lake Kipawa, P. Q., to obtain information as to the relationship of the necessary stop-log lifting power with the time of travel of each log. The experiment was made by Mr. R. L. Haycock, consulting engineer of Ottawa, under the supervision of Mr. C. R. Coutlee, C.E., engineer in charge of the Upper Ottawa river storage. Fig. 1 shows a plan of Lake Kipawa indicating the location of the dam. The procedure was as follows:

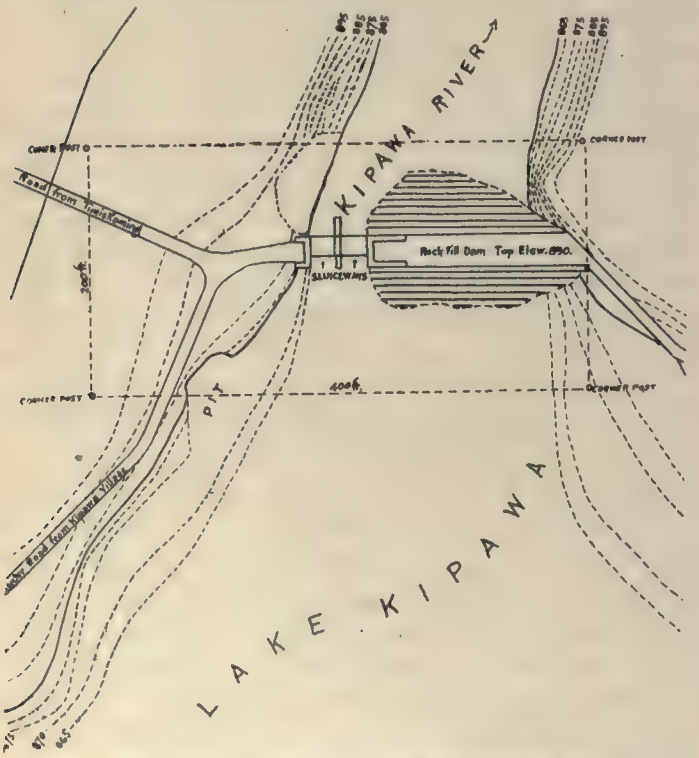


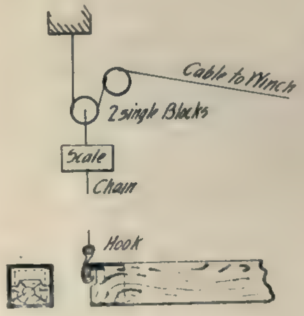
Fig. 1—Map of Lake Kipawa showing location of dam

First the logs were lowered to position and the dam closed. The first part of the experiment was to obtain the necessary power and time required for the manoeuvre of the logs. A second experiment was made to record the moving strain at different intervals from the sill to the top of the dam, with a single log first and then with a double log, many readings being taken while the logs were being raised. A Fairbanks scale was used for the experiment. One scale only was employed, the other end of the log being raised by the log lifting machine. The machines, blocks, cable, etc., were carefully oiled and kept in good order during the entire operation. The arrangement for the first part of the experiment was as shown in fig. 2.

In all cases the figures are for the total pull for both ends of the logs. For the first log the lake level was just flush with its top. The moving strain was 2100 pounds and was practically constant for about 2 inches travel. To the top of the dam the total travel was 13.6 feet and the time absorbed was 16 minutes, or 1.18 minutes per foot. The next log (2nd from surface of water) had a head over it of 1.5 feet taken from the lake level. The moving strain was 4,800 pounds and was practically constant for about 1½ inches travel. The travel to the top was 15.1 feet and the time 1.65 minutes per foot. The next log (3rd from the surface of water) had a head over it of 3 ft. The moving strain was 6,000 pounds and was practically constant for 2 inches. The total travel was 16.6 feet and the time 25 minutes, or 1.5 minutes per foot. The fourth log from the surface of water had a head of 4.5 feet over the top of it. The moving strain was 7,200 pounds and was constant for about 2 inches travel. The time required was 30 minutes and the travel 18.1 feet or 1.67 minutes per foot. The fifth log from the surface of the water had a head over the top of it of 6 feet. The moving strain was 8,000 pounds and was practically constant for 2 inches. The travel was 19.6 feet and the time required 35 minutes, or 1.8 minutes per foot. With this head of water it was difficult hooking on to the end of the log.

The sixth log had a head over it of 7.5 feet. The moving strain was 4,600 pounds and was practically constant for about 3 inches travel. The travel to the top of the dam was 21.1 feet and the time was 38 minutes or 1.8 minutes per foot. Here it was surmised that this smaller strain, obtained when greater strain was expected, was due to the log not being down properly in place, but when the log was shoved back to position and pulled again the strain was found to be the same.

The seventh log had a head over it of 9 feet. The moving strain was 4,800 pounds and was practically constant for about 2 inches travel. The time required to move the log to the top was 50 minutes or 2.21 minutes per foot for the 22.6 feet of travel. The next logs (two battened together, the 8th and 9th from surface of water) had a head of 10.5 feet on top of them. The moving strain was 7,200 pounds, and in-



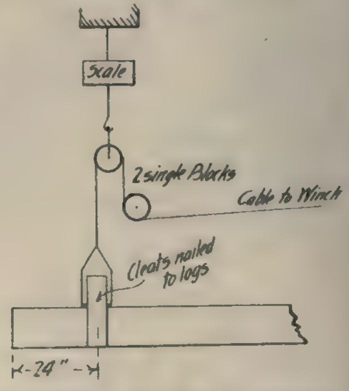


Fig. 2 (left)—Arrangement for lifting stop logs to determine pull required.
Fig. 3 (right)—Arrangement for lifting bottom log.

creased to 7,600 pounds with about 4½ inches travel. The travel was 24.1 feet in 70 minutes to the top of the dam or 2.9 minutes per foot.

The tenth log from the surface of the water being the bottom log, the attachment was made as shown in fig. 3. The readings on this log were taken at intervals all the way from the bottom to a position when the log was clear of the water.

The following table shows the readings at the different intervals between the sill and the surface of the water.

Distance Top of logs to top of concrete	Total pull on log (both ends)	Remarks
16.5	3500 ”	Log on sill
24.5	3300 ”	
23.5	2800 ”	
22.5	3000 ”	
21.5	3700 ”	
21.0	4500 ”	
20.5	4100 to 4700 ”	
19.5	5100 ”	
19.0	6000 ”	
18.5	6600 ”	
17.5	6000 ”	
17.0	4100 ”	
16.5	3500 ”	Log just touching water

The distance from top of concrete to sill was 27 feet, which makes the distance from the top of one log on sill to top of concrete, 25.5 feet.

The following table shows the readings at different intervals between the sill and the surface of water, the experiment being made this time with a double log. Attachment was the same as for the single log.

Distance Top of Log to top of concrete	Total pull on log. (both ends)	Remarks
24.0 feet	4200 pounds	
23.0	8800 ”	
22.6	9700 ”	
22.4	11500 ”	
22.0	10000 ”	
21.6	8200 ”	
21.0	7100 ”	
20.0	7000 ”	
19.2	7000 ”	
19.0	6000 ”	
18.6	6000 ”	
18.2	5700 ”	
18.0	5800 ”	
17.6	6100 ”	
17.3	6900 ”	
17.0	7000 ”	
16.0	7300 ”	
16.8	9800 ”	
16.6	10000 ”	
16.5	11500 ”	
16.3	10900 ”	
16.2	11000 ”	
16.0	11500 ”	
15.6	11800 ”	
15.4	12000 ”	
15.0	12800 ”	
14.8	12700 ”	
14.6	11800 ”	
14.3	11000 ”	
14.0	11100 ”	
13.7	11200 ”	
13.3	11000 ”	
12.4	7000 ”	
12.0	6000 ”	
11.0	6500 ”	Water level with tops of logs at centre and clear of bottom at both ends.

Note.—The increase in power and the falling off again is probably due to the velocity of flow and occurs when a certain relation exists between the volume passed below and above the logs.

Peterboro Housing Commission

Last year's Housing Commission, at Peterboro, Ontario, composed of Mayor McIntyre and Messrs. Frank H. Dobbin and James Finnie, has been reappointed under the 1920 Housing Act. At a recent meeting of the City Council, Ald. Turner advanced a resolution to transfer King Edward Park to the Housing Commission for subdivision into lots on which to erect 24 houses. This scheme found a good deal of favor with the Council, but nothing definite has been done as yet.

Trade Incorporations

Toronto Castings, Limited, with head office at Toronto, capital $500,000.

Muskoka Quarries, Limited, with head office at Toronto, capital $300,000.

The Classic Housing Company, Ltd., with head office at Stratford, Ont., capital $40,000.

Soil Pipe & Fittings, Limited, with head office at Three Rivers, Que., capital $140,000, to manufacture sewer pipes, etc.

Curran & Briggs, Limited, with head office at Toronto, capital $40,000, to carry on the business of general contractors.

Central Foundation Company, Ltd., with head office at Toronto, capital $50,000, to carry on the business of contractors.

J. O. Giroux Company, Ltd., with head office at Whitby, Ont., capital $40,000, to carry on the business of general contractors.

Good Homes, Limited, with head office at Montreal, capital $49,000, to carry on the business of builders and contractors.

W. H. Bagshaw, Limited, with head office at Toronto, capital $40,000, to carry on the business of engineers, contractors, etc.

Hamilton Contracting Company, Limited, with head office at Hamilton, capital $40,000, to carry on the business of general contractors.

Reid-Riddell Engineering Company, Ltd., with head office at Toronto, capital $40,000, to carry on the business of engineers and general contractors.

La Compagnie d'Entreprises de Shawinigan Falls, Limitee, with head office at Shawinigan Falls, capital $25,000, to carry on the business of building contractors.

Montreal Branch E. I. C.

The annual meeting of the Montreal branch of the Engineering Institute of Canada was held on May 27th, when the officers for the ensuing year were elected as follows:—Chairman, Mr. Arthur Surveyer; vice-chairman, Mr. J. H. Hunter; secretary-treasurer, Mr. J. L. Busfield. There was a contest for the three vacancies on the Council, the result of the ballot being the election of Messrs. John T. Farmer, O. O. Lefebvre, and Geo. A. McLeod; these will sit with the following members, who have another year in office—Messrs. W. J. Francis, J. Duchastel, S. F. Rutherford, and K. B. Thornton.

Mr. Francis, who presided at the meeting, referred to the excellent season's work just concluded, and to the services given by the officers and council. He mentioned that the papers and literature sent out by the branch had exceeded that of all the other branches put together. Mr. Surveyer then took the chair and returned thanks for his election.

Mainly Constructional

East and West—From Coast to Coast

Mr. Thos. W. Lamb, architect, of Toronto, has moved his offices from 39 Adelaide St. W. to 269 Victoria St.

A new stone crushing plant will shortly be located at Durham, Ont. Mr. John A. Russell, well known in Toronto contracting circles is at the head of the undertaking.

The bricklayers at Hamilton have accepted the employers' offer of $1.00 an hour subject to the award of a board of arbitration. The men had been on strike since April 30 and were demanding $1.15 an hour.

The Spanish River Company, of Espanola, Ont., have commenced the construction of fifty houses at that point. The houses are being built from plans similar to those used in last year's house building programme.

The Pacific Roofing Company will shortly enlarge its present plant on Industrial Island, B. C., by adding a new factory at a cost of $125,000 to be devoted exclusively to the manufacture of wall board building paper, etc.

The town council of Belleville, Ont., at a recent meeting, adopted Ald. Ponton's proposal to exempt from taxation for the years 1921 and 1922, all houses erected during the present year, with the exception of houses erected under the Housing Scheme.

The Canadian Cottons, Limited, are building a plant at Hamilton which will have a capacity of 1,000,000 lbs. of yarn annually. The dimensions of the new factory will be 175 ft. by 125 ft., part of the building being six storeys in height while the remainder will be four.

Plans for 100 workmen's homes to be erected at Windsor, Ont., this year by the local Housing Commission, have recently been approved by the provincial architect and tenders will be called immediately for the construction of these. A system of watermains and sewers will be laid to serve these houses.

The Matheson Products Company, a new firm, will shortly commence the manufacture of brick at their plant at Matheson, Ont. The company will turn out 20,000 bricks per day at the start, but it is expected to increase this capaciy five times in a short while. Mr. R. S. Potter is president of the new concern and Mr. R. L. Ollman, manager.

The name of the Winnipeg Ceiling & Roofing Company, of Winnipeg, has been changed to Western Steel Products, Limited. The company has greatly expanded since its incorporation in 1904 and as its original product, metal roofing, now represents less than 10 per cent. of the output, it was decided to change the name of the firm.

Mr. Thomas McLaughlin was awarded the tender, by the Ottawa city council, for the construction of Cummings Bridge. The tender price, $288,964, does not include the purchase price of Cummings Island nor for the preparation of the bridge approaches. The island will cost the city $30,000 and the construction of the approaches, it is estimated, $40,000.

The recent election of officers of the Niagara Peninsula branch of the Engineering Institute of Canada, held at Niagara Falls, Ont., resulted as follows: Chairman, W. P. Near, St. Catharines; vice-chairman, N. R. Gibson, Niagara Falls; secretary-treasurer, R. P. Johnston, Niagara Falls; executive committee: H. L. Bucke, Niagara Falls; W. H. Sullivan, St. Catharines; S. S. Lazier, Thorold; A. J. Grant, St. Catharines; ex-officio, A. C. Blanchard, Niagara Falls; Lt.-Col. R. W. Leonard, St. Catharines.

The Queen Victoria Park Commission of Niagara Falls, Ont., has purchased from the Hydro Electric Power Commission of Ontario a right-of-way for the construction of a boulevard from Niagara Falls to Queenston. A small portion of land near Brock's monument and another small portion of the northern boundary of Niagara Falls will have to be expropriated. This will complete the right-of-way controlled by the Commission from Lake Ontario to Lake Erie. Surveyors are at present at work and no time will be lost in completing this work. The purchase price of this newly acquired section was $100,000.

Personal

Mr. C. H. Jette, B.A.Sc., C.E., A.M.E.I.C., has tendered his resignation as assistant engineer, Department of Public Works, Canada, and has accepted a position in the engineering department of the St. Maurice Paper Co., Three Rivers, Que.

Mr. C. J. McKay, assistant provincial road engineer for the Merritt district, B. C., has been appointed engineer for the Cariboo-Lillooet district and will enter upon his new duties at once. Pending the appointment of a successor to Mr. McKay in the Merritt district, Mr. G. B. Whitehead, engineer of the Kamloops district, will take over the duties of the office.

Mr. H. J. Moore has been appointed Forester of Highways by the Provincial Government of Ontario with office in the Parliament Buildings, Toronto. Mr. Moore's work will consist of the planting of shrubs and trees and the general beautification of highways throughout the province. He was formerly chief gardener of the Queen Victoria Park Commission of Niagara Falls, Ont.

Mr. Ivor F. Roche, B. Sc., a member of the Montreal staff of the Lignite Utilization Board of Canada, has been appointed resident engineer at Estevan, Sask., in charge of construction of the first of the briquetting plants to be erected by the board in the west. Mr. Roche was formerly on the engineering staff of the Canadian Light and Power Co., and later engaged with Fraser, Brace & Co.

Mr. H. L. Seymour, A.M.E.I.C., assistant to Thomas Adams, housing and town planning adviser to the Dominion Government, will soon sever his connection with the government in order to accept an offer of partnership with Frank Barber and R. O. Wynne-Roberts, consulting engineers, Toronto. Mr. Seymour has been very prominent for several years past in town planning activities, and played a leading part in the formation of the Town Planning Institute of Canada. In his new connections Mr. Seymour intends to link town planning with the firm's other activities.

Obituary

Mr. John McKergow, Montreal, president of Peter Lyall & Sons Construction Co., died on May 16th from double pneumonia. He was for many years president of the Laprairie Brick Co.

Mr. Donald Patterson, formerly engineer of Huron County, Ont., died recently at his home in East Wawanosh, Ont. Mr. Patterson was 72 years of age and had occupied the position of county engineer of Huron for thirteen years, resigning this position last December on account of ill health. Mr. T. Roy Patterson, son of the deceased, succeeded his father in the above position.

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Our Annual Number

IN this, our Annual Number, will be found a variety of articles bearing the imprint of authors who are authorities in their respective fields. Thus there are such names as Dr. G. G. Nasmith, W. G. Chase, F. A. Dallyn, F. A. Macallum, and others, whose work along special lines has long been recognized throughout Canada as of special merit. All of these authors have prepared for the Contract Record treatises that discuss the problems in a style indicating wide experience along their particular lines. Thus the article by Dr. Nasmith develops the subject of "Chlorination as a Means of Disinfecting Water Supplies," with thoroughness and exhaustiveness. Mr. Dallyn's subject of "The Relation of Water Purification to State Sanitation" is of the utmost importance in these days when the good of the state is the good of the individual. It emphasizes the important bearing of water purity on public health. Somewhat the same idea is brought out in another way by N. J. Howard in his article giving a history of the development of Toronto's water supply. It is an interesting story of the progress of purification of a city during fifty years of rapid growth, written primarily to indicate the relation of purification to public health. The result of constant efforts on the part of Toronto's sanitarians and water works engineers has been to give her the second lowest typhoid death rate in America. Another interesting water supply development is recorded in the description prepard by E. M. Proctor on the New Toronto system. This article will appeal to a great number of our readers, no doubt, because there are hundreds of towns in Canada of about the same size and type as New Toronto. Mr. Chace has for this issue chosen to discuss the effect of alkali soils on concrete. It is his statement that millions of dollars are being lost through injury and failure of concrete structures in Western districts where alkali soils are proving deadly injurious. This is enough to cause great concern and should be a means of stimulating investigations so as to produce an alkali-proof concrete.

In the matter of roads, this Annual Number takes a prominent part. Never have highways expenditures in Canada been on so large a scale. Never has road building so taken the country by storm. Last week the Winnipeg convention of the Canadian Good Roads Association was the most successful ever held. At it was displayed great enthusiasm and confidence in the various provincial and municipal road-building policies. The whole meeting bespoke a future for highway construction that is hard to comprehend. The Contract Record in this issue, therefore, gives considerable space to road articles and convention news. It reproduces a few of the best papers read at Winnipeg; others will appear in subsequent issues. In doing this we are formally recognizing the fact that the construction of highways is one of the most important projects ever undertaken by the people of Canada.

June 21 to 24—The dates of the Montreal Convention of the American Water Works Association.

The Bearing of Water Purification on Public Health

WATER purification bears a very important and intimate relation to municipal sanitation. A study of the circumstances surrounding epidemics of enteric diseases have indicated that, in most cases, some impurity or pollution in the water supply was fundamentally the cause of the outbreak. Some relationship between water purification and public health was thus suggested, which, while formerly conjecture, has been firmly established by modern developments and investigations in the science of bacteriology. These researches throwing a new light on the art of preventive medicine, have been of untold assistance in minimizing water-borne diseases and in so doing, as statistics show, health conditions have been improved and the general mortality rate reduced.

The relationship of water purification and state sanitation is the topic ably discussed in this Annual Number by F. A. Dallyn, sanitary engineer of the Provincial Board of Health of Ontario. Mr. Dallyn, in developing this theme, places in two quarters the blame for the toleration, frequent on this continent, of infected water supplies. To the unprecedented industrial development of many cities can be partially ascribed the reason for this condition, for with the growth of communities, especially those on large bodies of water, sewage was permitted to discharge untreated into the same water from which the supply was drawn. A second reason lay in the insufficient knowledge of preventive medicine to warn communities of the dangers of such procedure.

However, the isolation of the typhoid organism and the determination of its existence in excreta has established the true significance of the relation between water purification and public health. It is only within late years that the public has shown itself willing to be informed, for which reason the propaganda of the public health laboratory has been slow in taking effect. At least, however, its work has been of incalculable benefit, for the typhoid rate is yearly approaching more nearly the irreducible limit. In the United States a reduction in the death rate from 23.5 to 12.4 per 100,000 in nine years is noted and coming nearer home, Ontario can show a remarkable achievement in a rate of 5.6 per 100,000 in 1919 as compared to 31.5 in 1910. The Provincial Board of Health is largely responsible for this and it can be said to its credit that it thoroughly appreciates the responsibility placed upon it of controlling in no small degree the health of the province.

The community rather than the individual idea of sanitation is gaining ground—by that we mean that the tendency is towards the improvement of the general health of a community by a control of factors which apply to the community as a whole rather than to separate individuals. This conception of public or state sanitation is beyond doubt the proper one, for it aims to get at the basic causes of disease and lack of sanitation—in other words it is a case of prevention being better than cure—and it furthermore does not interfere with or minimize any efforts that may be directed to individual improvement.

That water purification plays a big, possibly the biggest part, in the matter of state sanitation is axiomatic. Suffice it to say that in the article on page 526 of this issue Mr. Dallyn establishes their inter-dependence. Take measures to improve the water supply of a community and health naturally improves.

No Scrapping of Equipment in Frequent Enlargements of This Waterworks Plant

THE description of the waterworks system of New Toronto, Ontario, given elsewhere in this issue, contains more than usually interesting information. The feature of the project has been the frequent enlargement made necessary by the remarkable industrial growth of the town accompanied by a fourfold increase in population in seven years. Starting off in 1913 with a small plant of two 250-gallon-per-minute pumps, the town now has an installation supplying 2,500,000 gallons per day, the greater portion of it for industrial purposes. The unusual feature of the extensions, necessitated from time to time to take care of the growing demands, is that no part of the original plant or of the subsequent additions has been scrapped to make way for the present installation. Even the original pump-house is incorporated in the existing building and additions have been added and the new equipment installed in a manner that is ingenious in its simplicity.

This piecemeal method of providing a waterworks system might be considered a doubtful procedure, and in the case of a town of which the population increases in no abnormal amount, it is the height of engineering folly to fail to anticipate the needs of the future. It must be remembered, however, that in New Toronto's case, the failure to provide in 1913 a plant sufficient for the needs of 1920 was not due to any neglect on the part of the designers to consider the possibility of increased demands but to a tremendously war-stimulated industrial development which was beyond any expectation or power of forecast. Then too, the fact that, when the demands for water were pressing, materials were scarce and expensive, induced the town to spend money cautiously meeting the demands only as they arose. The result, however, was unusually successful, for today the town has a thoroughly up-to-date plant which has not necessitated any scrapping of equipment or tied up any capital unnecessarily.

In mentioning New Toronto's plant, it is worth noting in passing that it is a joint venture as are others of its public utilities. The adjoining town of Mimico has a working arrangement whereby it buys water from New Toronto at an agreed charge. On the other hand, Mimico takes care of the sewage disposal of both itself and its neighbor. In the near future it is expected that New Toronto will also serve water to other adjoining municipalities. Where feasible, some scheme of this sort is worth considering. It has worked in the case of these towns, and in others similarly placed, it is possible that some equally and mutually satisfactory and beneficial arrangement can be made. Certainly the capital expense of a central plant is less for two plants of the same total capacity and it might easily be made remunerative enough for one municipality to carry the extra burden and supply a service to a neighboring community.

Uncertainties About Effect of New Tax on Contractors

AT a special meeting of the Board of Directors of the Montreal Builders' Exchange held at Montreal on May 28th, the effect of the new taxation proposals of the Dominion Government on the building industries was discussed.

While in the main, no serious objection was taken to the various taxes to be imposed, it was considered that the Government required the money, and that ultimately the consumer will have to pay, exception was taken to the proposal that building contractors, trade contractors and others connected with the building trades should have to forward to Ottawa twice each month statements of the amount of business done during each half-monthly period.

It was pointed out that the practice has been for architects to issue their certificates monthly, and that this has to a large extent regulated the manner in which a building contractor finances his operations. Although it was not deemed necessary to petition the Government, either by resolution or deputation, to have any changes made in the amount of taxes to be imposed, or their distribution among the various classes of the community, nevertheless, it was felt that the exchange should concern itself without loss of time with the method by which the Finance Department proposes to collect the various taxes, and the system to be adopted to secure the required financial statements

In order that each of the sections of the Exchange should have an opportunity of stating concretely the difficulties encountered in carrying out the provisions of the new taxation proposals, it was moved by Douglas Bremner, seconded by A. W. Bremner, and adopted unanimously, that K. D. Church, chairman of the general contractors' section; F. J. Parsons, chairman of the Trade contractors' section; J. K. McNutt, chairman of the Supply Dealers' section, and the general secretary, D. K. Trotter, should draft a questionnaire to be submitted to the Finance Department, asking in general for a ruling on various difficulties that are anticipated in carrying out the new taxation proposals.

Following the decision of the directors of the Exchange, meetings of the supply dealers' section and the general contractors' section were held on June 1st, at which various questions were drawn up to be submitted to a special committee comprised of the chairman of all the various sections which will get the necessary information. One of the most important matters discussed by the general contractors was in regard to contracts accepted prior to May 19th, when the budget was delivered. The question is whether the contractors can add to the contract price the cost of the tax which they have had to pay for the materials which go into such buildings. One official opinion secured was in the affirmative, but pointing out also that it was a legal question. It was suggested that this matter should be straightened out, and in time to allow of an amendment to the act in case there should be any doubt.

The general opinion was that the contractors do not have to pay anything direct to the Government under the new taxes, this not being a business tax, but paid indirectly when they paid for the materials they bought.

Another question raised was in regard to containers. It was pointed out, for example, that cement reaches the contractor in bags and the bags are charged for, and when returned credited back. The question now is whether the cost of the bags should be included in the invoice price on which is based the sales tax. Another issue was that of freight and cartage. It was pointed out that crushed stone delivered at the job would run about $1.50 a ton, but more than half of this would be freight and cartage, and the Government will be queried on this point as well, for the contractors believe the principle is that freight charges are not included in cost of materials.

Corporation of Professional Engineers of Quebec Now Operating

THE first meeting of the Corporation of Professional Engineers of the province of Quebec, held at the headquarters of the Engineering Institute of Canada, Montreal, on May 27th, was largely attended. Mr. A. R. Decary, of Quebec, who presided, explained that the formation of the corporation was the outcome of a resolution passed at the annual meeting of the Engineering Institute of Canada in 1919, and that the members were confined to engineers resident in and practising in the province. With the consent of the Council of the Institute, an act had been passed in the last session of the Provincial Legislature transferring the powers of the Institute, under their Provincial Act, to the new corporation. A provisional council had been formed and had carried out the preliminary work.

The bill, as read by Mr. F. B. Brown, gives power to the Corporation to be managed by a council of eight members, the Corporation being affiliated to the Engineering Institute of Canada, with headquarters in Montreal.

Mr. Decary added that the province of Quebec was the first to secure legislation on the lines indicated and that since then, the other provinces, with two exceptions, had followed suit.

The election of a new council was then proceeded with. For the first year the province is to be divided into two sections—from Three Rivers westward, with five members, and from Three Rivers eastward, with three members. Of these, four will be elected for two years, and four for one year. It was proposed to elect the provisional council en bloc, which was strongly objected to. After the rejection of two or three amendments, the provisional council was elected as follows:

West of Three Rivers: Messrs. Arthur Surveyer, W. F. Tye, Walter J. Francis, K. B. Thornton, and Fred B. Brown, of Montreal; east of Three Rivers: Messrs. A. R. Decary, A. B. Normandin, and J. Gibeau, Quebec City.

The meeting then discussed the by-laws, only those of a routine character being adopted. The by-laws relating to fees will be discussed at a later meeting.

At a subsequent meeting of the council the following officers were elected: President, A. R. Decary Quebec; vice-president, Walter J. Francis; honorary secretary-treasurer, Fred B. Brown.

During May the Montreal building permits totalled $1,667,383, an increase of $397,948 on the corresponding month last year. For the five months the total was $6,085,034, a gain of $3,932,027.

Growth of New Toronto Waterworks System from Village Supply to Large Plant

An Exceptional Industrial Development of the Town Created Demands for Water Which Were Met by Frequent Additions to Plant and Equipment—Result Has Not Been Incoherent as Might be Expected But a Scheme in Which the Original Plant Has Been Made to Fit in with Later Improvements

By **E. M. Proctor**, B.A.Sc., A.M.E.I.C., Manager, E. A. James Co., Ltd., Engineers, Toronto

NEW TORONTO, Ont., is a town situated on the north shore of Lake Ontario about six miles west of the city of Toronto and bordering on the west boundary of the town of Mimico. The plant which this article will describe supplies water for both the town of New Toronto and the town of Mimico which to-day have a combined population of 7,000 people. In 1913, when the construction of the plant was commenced, New Toronto had a population of 800 and Mimico 1,000.

The tremendous industrial growth in this district largely accounts for the increase necessary in the capacity of the waterworks system. At the present time there are located in New Toronto, the Canadian plant of The Goodyear Tire and Rubber Company and plants of the Dupont Fabrokoid Co.; Brown's Copper and Brass Rolling Mills, Boxer Wall Paper Company, Ritchie and Ramsay Paper Co., and numerous other industrial concerns. Besides these industrial plants water is supplied to the G. T. R. Mimico yards, which are the main incoming freight yards on the Toronto and Hamilton main line. The G. T. R. alone in this connection uses an average of 600,000 gallons of water per day.

Utilities are Joint Propositions

There are several reasons why New Toronto and Mimico combined to build a waterworks system, the chief and most important reason being that the natural sewage outlet for the district is in Mimico, and at New Toronto there is a very suitable point upon which the waterworks plant was constructed. It might be interesting to note in passing that the sewerage system of the two municipalities is also a combined system. Their incinerator, too, is a joint municipal venture. The basis of co-operation between the two municipalities is that New Toronto sells the water through a Venturi meter to Mimico. Mimico maintains its own distribution system and collects its own water rates. The agreement calls for a minimum consumption of 50,000 gallons per day and the rate at present is 0.8 cents per 1,000 gallons.

The initial plant installed included two 250 gallons per minute electrically-driven centrifugal pumps, one of these pumps having attached to one end of the shaft a Sterling gasoline engine as shown on fig. 8. The water was secured through an 18 in. steel intake in 30 ft. of water 1200 ft. off shore and after coagulation in a 25 ft. diameter subsidence basin was pumped directly through two 8 x 16 ft. pressure filters. Fig. 1 is a photograph of the initial pump house. This system was barely in operation a year when the demands upon it exceeded the capacity and an extension was made to the plant as shown on fig. 2. This extension lengthened the pump room and the filter room and added an office and room for bacteriological laboratory. At the same time an overhead hand-operated crane was installed to take care of the lifting of the pumps. A 600 gallon per minute electrically driven pump designed for high pressure—shown as pump No. 3 on the plan—was also purchased at that time. Two additional filters, 8 ft. x 16 ft., were also purchased and installed. This work was completed in the fall and winter of 1916.

Large Industrial Pumpage

In 1917 the Goodyear Tire and Rubber Company, after considerable negotiations, decided to take a supply of water from the municipality and since they did not wish filtered water, but would take raw water from the lake, extensions were again necessitated. This time a wing was placed on the west end of the pump house and increased office space was supplied; a work room and a hot water heating system was also installed. Fig. 3 shows this extension complete. At this time an additional coagulation basin was built and a screen chamber constructed to screen the raw water going to the Goodyear tire plant. The location of this screen chamber and the coagulating basin are shown on the plan (fig. 7.) To supply the Goodyear Tire Company two 1,000 gallon electrically driven centrifugal pumps designed for a head of 320 feet were installed; these pumps were manufactured by the Epping Carpenter Company. They get their supply through a screen chamber and pump directly through a separate main to the Goodyear plant.

The financial arrangements for the pumping of this water to the Goodyear plant are based upon the pro-

Figs. 1 to 3.—These illustrations indicate the extensions to the pumphouse at New Toronto, made necessary by industrial expansion and growth of population. The original pumphouse is shown at the left, the other pictures showing subsequent enlargements.

portional cost; the charges for maintenance, operation, etc., being made as per water pumped of the total for the plant. All capital charges of the equipment required by the Goodyear Tire Company are also carried by them and all electrical energy is measured separately for the two systems. These charges form the basis of the water rates charged to the company.

About the same time a 1,000 gallon per minute high-pressure centrifugal pump operated by a 150 h.p. Van Blerk gasoline engine was installed to take care of interruptions in the hydro-electric service. A swivel hand-operated jib crane was installed in this wing of the pump house to lift the pumps when necessary. During the installation of the Goodyear equipment a switch board with provision for future additions was also installed. These various improvements were completed early in 1918.

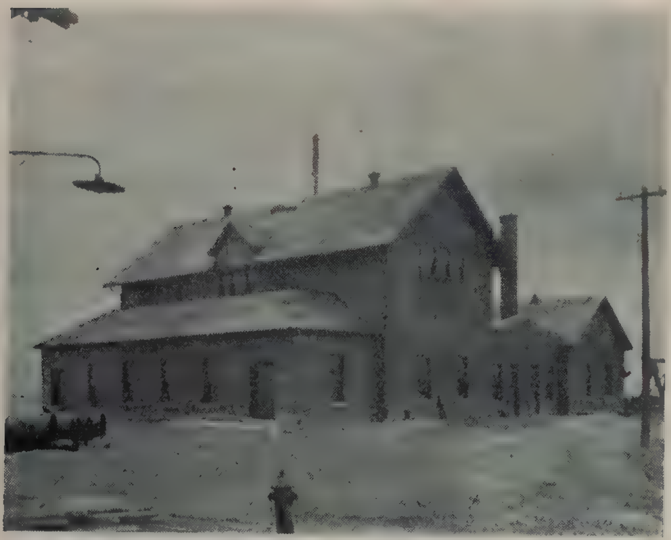


Fig. 4—The New Toronto pump and filter house as it is today

Filters Arranged in Two Tiers

In the summer of 1918 it was necessary to increase the filter capacity of the plant. At this time it was very difficult to purchase steel plate or any other kind of steel; but fortunately three filters which the city of Stratford, Ont., no longer required, due to their artesian well supply being developed, were purchased by the town of New Toronto. These filters were placed on flat cars at Stratford and shipped to New Toronto. From the cars they were moved by means of rollers and a capstan to the pump house. These shells containing the concrete bed for the manifold system which was not disturbed, weighed about 26 tons each and were quite a problem to handle. After a great deal of study and consideration, it was decided to place these filters on a steel frame above the existing filters, or in other words a second storey was added to the filter room and the new filters placed upstairs. To take care of this arrangement, the filter house roof was raised and a heavy steel frame work placed to support the filters. At the time of these alterations, a chemical store room and equipment store room were added as a wing to the east of the building. Fig. 4 shows the pump house with these additions complete. This arrangement of the filters makes a very compact system and makes it possible to connect the filters up with a minimum of pipe. These new filters are 8 ft. in diam. x 20 ft. long and bring the capacity of the filter plant up to about 2,000 gallons per minute. A 1,000 gallon per minute, electrically driven centrifugal pump for domestic pressure was also installed at this time, the whole work being completed in the fall of 1918.

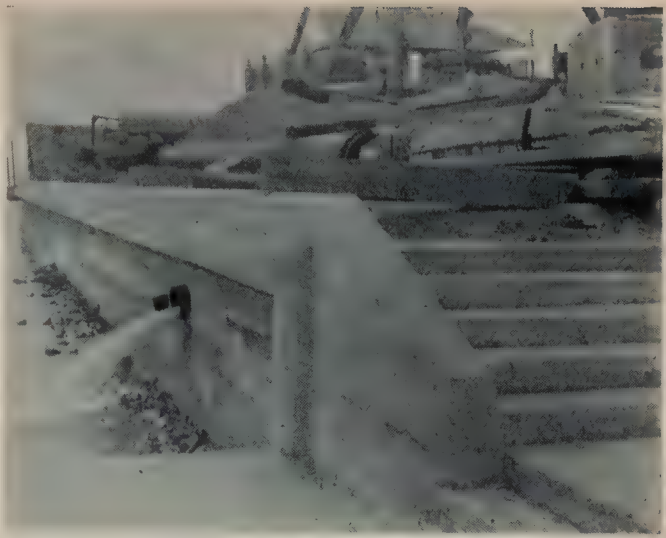


Fig. 5—The finished sea-wall with curved face which throws each wave back on the next oncoming wave, thus reducing the size of the breaker against the wall. The steps lead to a boat landing.

In 1919 a new intake was made necessary, due to the increased consumption of water and it was decided to lay another one 24 in. in diameter. At the same time a sea wall was constructed across the front of the pump house property, in order to prevent the continuous erosion of the bank which was becoming a serious menace to the pump house. The contract for this work was let on a cost plus 10 per cent. basis

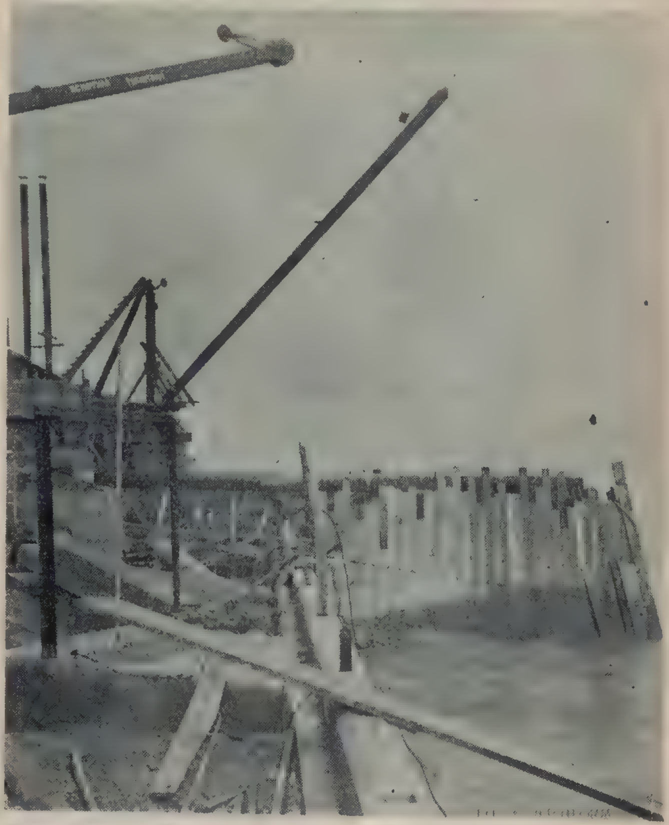


Fig. 6—Sea-wall and screen chamber during construction, showing coffer-dam in place for last half of wall

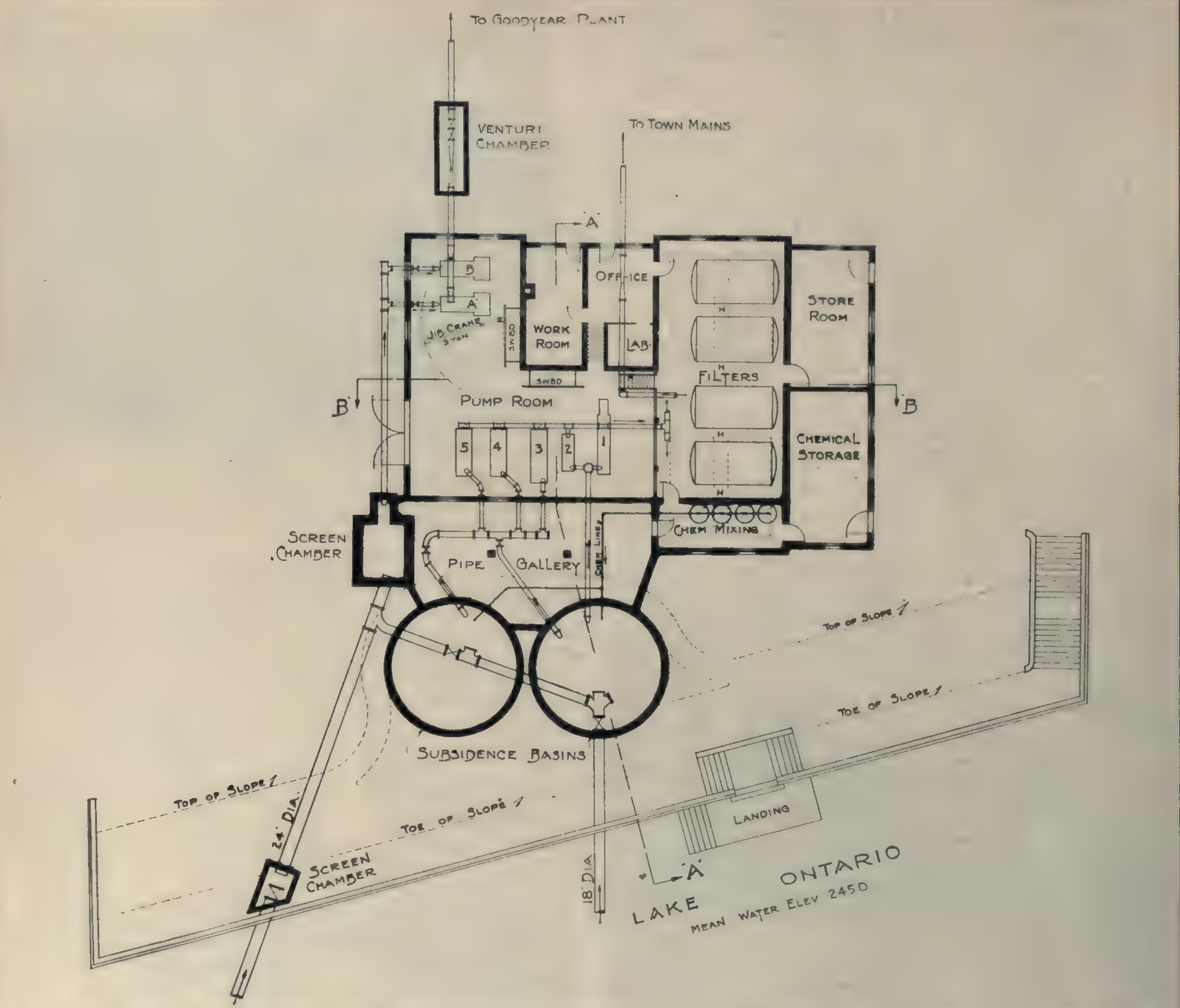
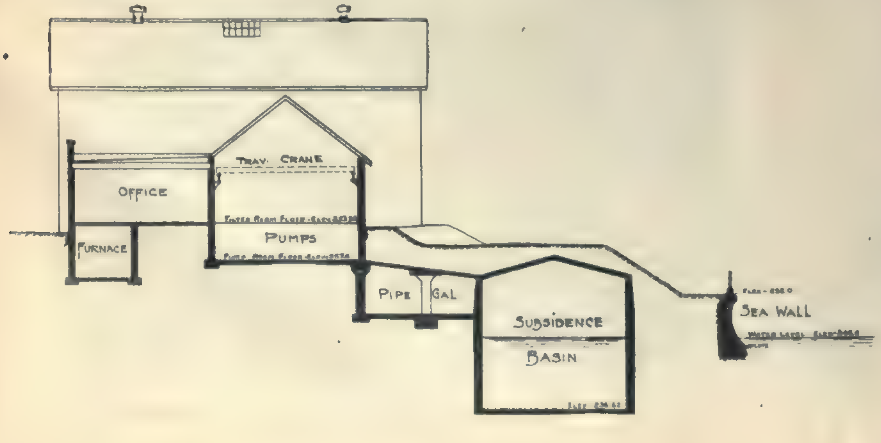


Fig. 7—Plan of waterworks at New Toronto, showing sea-wall, screen chambers, subsidence basins and filter and pump layout

to Mr. R. C. Huffman and was completed in the late fall of 1919.

Sea Wall Construction

The method of construction of this wall is shown in Fig. 6. Half the wall was enclosed in a cofferdam and the lake bed made bare, forms were placed and the wall poured. The cofferdam was then shifted and the other half of the wall placed in a similar manner. In fig. 6 is shown the cofferdam on the last section of the wall and in the foreground of the photograph is shown the screen chamber for the new intake. The steel gallows frame shown is for the purpose of lifting the screens from the well. These screens will be in duplicate and of about ¼ in. mesh. The pipe shown in the photograph is one section of the intake pipe. It is a seamless electrically welded steel



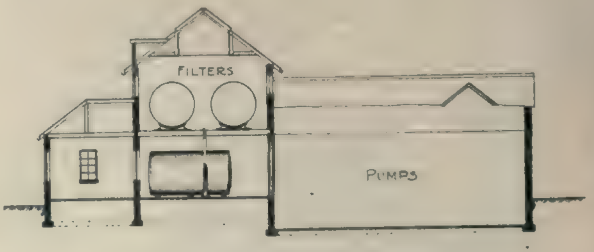


Fig. 8 (left) Section A-A, Fig. 7

Fig. 9 (above) Section B-B, Fig. 7

pipe and comes in 40 ft. lengths. The material is 3/16 in. thick. The section of pipe shown was used during construction to carry the wash water from the filters. In fig. 5 is shown the wash water outlet in the finished wall.

The intake is laid in a channel blasted in the bed of the lake, which at this point is a shale formation. The drilling was done from a specially constructed raft and the shale shattered by dynamite charges. The material from this trench was removed by means of a drag line bucket operating from a heavy anchored end in the lake to a derrick on shore. The pipe was placed by joining together two or three lengths which would be about 100 feet long floating this out and connecting under water by a diver. There are three ball and socket joints in the pipe line and the pipe is weighed down at intervals with concrete saddles. After the pipe reaches a depth of about 10 feet of water, it is laid directly on the shale bed of the lake. At the far end is placed a fish screen of ½ in. round bars in the shape of a globe. An inspection of the plan will show that either one of the intakes may be used, independently of the other.

Fire Emergency Service

The water is tested each day by the superintendent in a laboratory shown on the plan. This laboratory is equipped with an electric incubator, microscope and the various equipment necessary for B.Coli examination. All water is measured with Venturi meters. The water to the G. T. R. and also the water which goes to Mimico is measured by recording Venturi meters. At the north end of New Toronto near the G. T. R. yards is located a 75,000 gallon elevated steel tank, which is 90 ft. high to the over-flow. At the foot of this tank is located an electrically controlled valve which, in case of fire pressure being required, may be closed from the pump house by merely closing a switch. Closing this valve does not interrupt the G. T. R. supply from the town tank. There is also an alarm adjustment on the tank to warn the pump house men when the elevated tank is full.

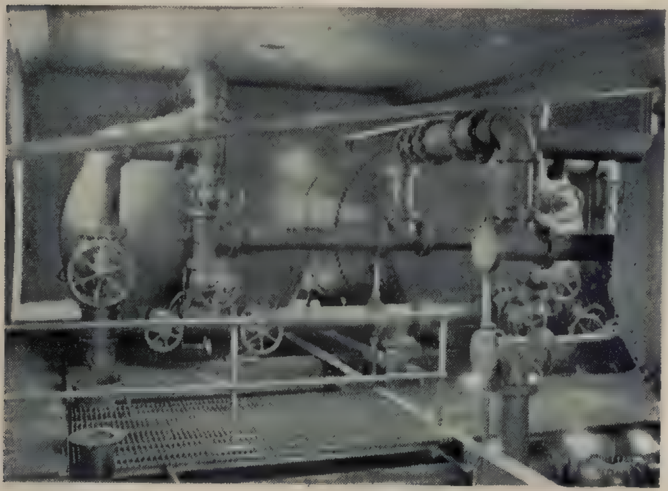


Fig. 10—Filters are arranged in two tiers, the upper of which is shown in this illustration

The distribution system is built up mostly of 6 in. and 8 in. mains, the main supply from the pump house being a 10 in. pipe. At the present time this is not large enough for the demands made upon it, and during the coming summer the town contemplates laying additional feeder main of 16 in. diameter and also installing a pair of 2,000 gal. a minute pumps which could be operated either in series or parallel.

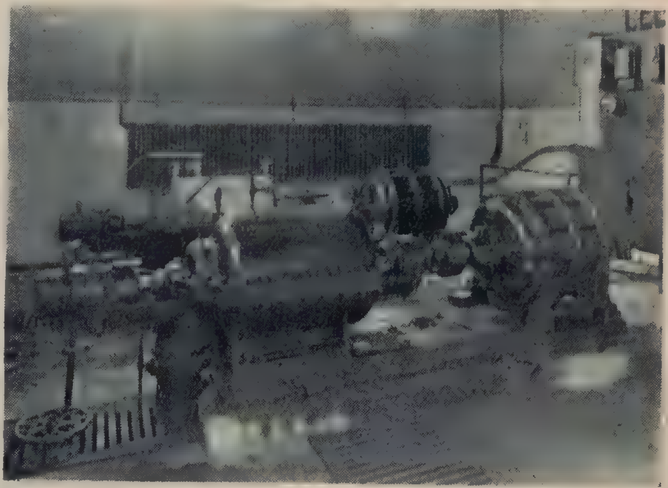


Fig. 11—The two pumps supplying the plant of the Goodyear Tire and Rubber Co. They are electrically driven

With these improvements—the new pumps and 16 in. mains—it will be possible to take care of a considerably enlarged load. At the present time all the available pumps are required to meet the demands upon the system. The area to the west of New Toronto which is called Long Branch is considering a waterworks system and they contemplate securing their water from New Toronto. If this development

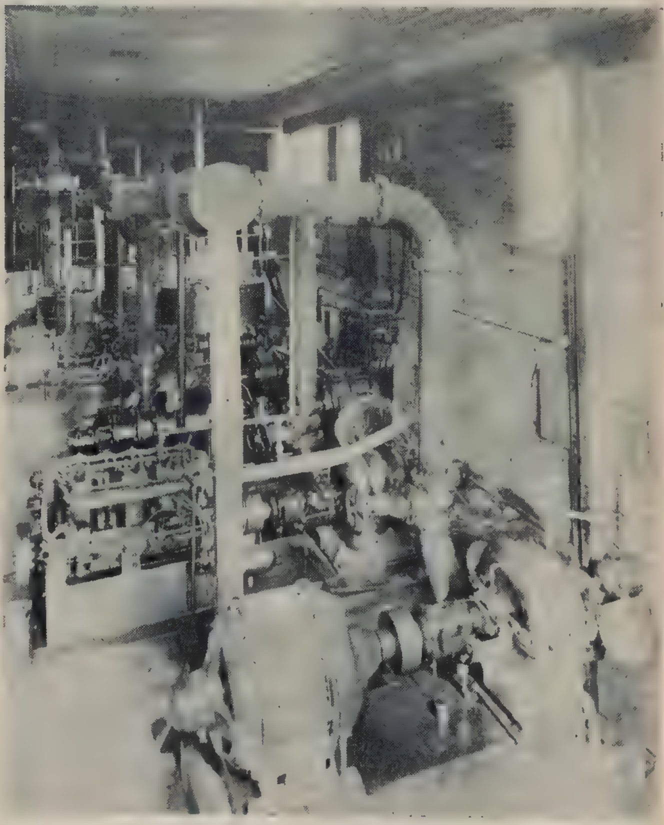


Fig. 12—View of pumps on town's supply. This photo was taken with a 25-minute exposure with pumps running at 1400 r.p.m. Note absence of vibration

materializes it will likely be necessary to make further additions.

Built on Instalment Plan

It might be thought that in a plant as above described the designers would allow for a considerable growth when deciding upon the size of the various units, but it must be remembered that the initial installation was merely a village supply, and that almost before it was in operation the war broke out and the various industries mentioned developed tremendously. The fact that materials during the war were very difficult to secure and very expensive, and that financing was not a very easy matter, made it necessary for the town officials to go cautiously and as a result the policy of meeting the demands as they arose was adopted. This policy has proven very successful, because no part of the equipment has been behind in connection with the improvements and to-day the town has been built, one might say, on the instalment plan since its inception. If the plant which is in existence to-day had been proposed when the original plant was built, the cost would have made the venture prohibitive.

The average daily pumpage is now two and a half million gallons and no doubt will be increased as the town develops.

The plant and all extensions were designed and carried out under the supervision of the E. A. James Company, Limited, Consulting Engineers, Toronto. Practically all the construction work has been done by Mr. R. C, Huffman, Toronto.

How New Tax Affects Contracting

Important Rulings That Bear on Building Contractors and Sub-Contractors — Tax is Not Chargeable on Amount of Contract—Have to Pay One Per Cent. on Material Used by Them—Tax May be Recovered from Owner

IN view of the uncertainty and numerous questions raised as to the effect of recent tax resolutions on the construction industry, the following information has been obtained from G. W. Taylor, Assistant Deputy Minister of Inland Revenue, and incorporated in a A.C.B.C.I. Service Letter.

The tax is primarily one upon materials, and is not intended to be a tax upon labor. Labor used in the installation of materials is not taxed, but the tax does apply to labor used in the manufacture of materials.

Art. 7 of the resolutions provides for a tax of one per cent. (1%) to be collected on sales by manufacturers and wholesalers, this tax to be paid by the purchaser to the wholesaler or manufacturer at the time of sale.

Contractors and sub-contractors will have to pay one per cent (1%) tax on materials used by them.

Products of the soil, such as sand, gravel and unprocessed stone, are not taxed. Lime, cement, and stone which is quarried, crushed or which passes through any process, come under the tax.

Tax on materials is payable on everything shipped or delivered on or after May 19th, 1920, unless it can be proved that the complete price was paid in advance of that date. Partial payment is not sufficient.

Building contractors and sub-contractors, though technically manufacturers, are regarded for the purposes of the tax as retailers, selling to the consumer. Tax is not chargeable on the amount of contract, either between sub-contractor and contractor, or between contractor and owner.

If a contractor or sub-contractor manufactures materials for his work, such as metal cornices, sash and door frames, iron railings, etc., he is required to pay tax on cost of manufacture, including labor. He is not required to pay on installation.

In the opinion of the Inland Revenue Department, contractors ought to be able to recover tax from owners on contracts made previous to May 19th, 1920, for goods purchased or delivered after that date. This is, however, a question of law. On future contracts, the tax should be provided for.

Provincial and Dominion Governments are both subject to the tax.

Arrangements have been made to collect the tax from the wholesaler and manufacturer once a month, on the first of the month. A statement from the sales record is required, under affidavit, and marked cheque for the amount of the tax. Returns should be made to the nearest local collector of inland Revenue. (Retail stores have a different procedure.)

Copies of all rulings made by the Department of Inland Revenue have been sent to all local collectors, and consultation with these officers will probably save much time and expense in securing information required.

Dwellings in Grand Mere, P. Q.

The government of Quebec has allotted $100,000 to the city of Grand'Mere for the building of workmen's dwellings. The city is making a loan of $57,000 to la Cie des Logements Ouvriers de Grand'Mere of which Mr. J. L. Dostallaire and Mr. A. Desroche are the incorporators. The company intends to build fifteen six-room houses at an approximate cost of $3850 each. These houses will be of brick construction, modern finish and equipped with at least one fire place. The architects are Messrs. Ross & McDonald, Montreal. The company applied at first for the whole loan with the intention of building twenty houses; but the council has decided to share this amount between this company and Mr. Aime Ally, general contractor, Grand'Mere, who intends to build five houses of the same type. The Cie des Logements Ouvriers de Grand'Mere has already asked for tenders for the construction of these fifteen houses.

The town of St. Lambert, Que., propose to expend $500,000 on public works, including $100,000 for a fire station and public hall; $22,700 for new sewers; $68,000 for new water mains and enlargement of works; and the balance for sidewalks and pavements.

Organizing Municipal Works Departments on Business-Like Basis

The Big Spending Department of a City Requires Constant Supervision to Get as Much as Possible for the Citizens' Money—A Clearly Defined Scheme of Organization Plus a System of Costs Essential for Efficient Results—Foremen Are Backbone of the Department

By A. F. Macallum, C.E., Commissioner of Works, Ottawa, Ont.

A. F. Macallum, C.E.

UNDER the system of municipal politics in vogue in most Canadian cities it is extremely difficult to have the Works Department organized on an efficient basis by the official who has been in charge and it is only when a new chief is appointed that drastic changes or improvements can be carried out. The old official may, with proper backing, be able to change existing conditions, but only in a gradual manner and probably never to the standard that he realizes should be in force.

The engineering staff of a Works department should be sufficient to take care of nearly all the detail work, so that the chief may have sufficient time to formulate and develop the works sufficiently far ahead to meet the growth of the city. By so doing, the charge that city engineers, as a rule, lack initiative and foresight with regard to coming needs of a city, would lose its force and they would not wait until the citizens or council pointed out such requirements, often at too late a period for economic construction.

Lack of Staff in Small Cities

Unfortunately, the smaller the city the greater the difficulty of securing a sufficient staff and the writer knows of cities of twenty thousand population where the city engineer is practically the whole engineering staff. The consequence is that all his time is taken up with routine work that should be left to assistants so that his time might be spent on matters of importance only. As the cost of an engineering staff sufficient for a city is only about five per cent. of the cost of the work carried out during the year it is evidently good business to carry such a staff, but unfortunately, the average small city council does not recognize this, nor does it realize the money lost in carrying out work under incompetent supervision and often without sufficient study of future conditions.

> **Under the system of municipal politics in vogue in most Canadian cities, it is extremely difficult to have a Works Department organized on an efficient basis by the official who has been in charge, and it is only when a new chief is appointed that drastic changes or improvements can be carried out.**

Assuming a city of about one hundred thousand population, the engineering staff should include city engineer and deputy with assistant engineers in charge of sewers, pavements and water works and sufficient instrument men and draughtsmen to do the mechanical work.

The deputy engineer is directly in charge of the assistant engineers, gives them instructions and is in constant touch with all the outside construction and maintenance work, including the foremen in charge of the different works.

The assistant engineers are responsible for the department under them, must know all details in connection with their work, besides the history of or defects in any work under their jurisdiction; in fact, they practically have the position of sub-contractors on a work. During the winter months, while outside work is at a minimum, their time is fully taken up in making reports, estimates, plans and specifications for future developments, besides supervising plants like pumping stations, incinerators and sewage disposal works. The rodmen and draughtsmen who are taken on during the summer months temporarily may be dropped as it is very seldom necessary to carry most of them throughout the winter season.

Efficient Cost System is Essential

In the organization of the municipal Works Department the accounting system should be placed on such a basis that the unit cost of all work, either local improvement or general expenditure, can be quickly and accurately determined. At the beginning

> **The engineering staff of a Works Department should be sufficient to take care of nearly all the detail work, so that the chief may have sufficient time to formulate and develop the works sufficiently far ahead to meet the growth of the city.**

of the year, when appropriations are made for various branches of the department and credited, expenditures commence, and the accountant should present a statement to the head of the department showing the expenditure each month, and a copy of this statement should be sent to each engineer, superintendent, or other official interested so that he will be in a position to make an accurate estimate for the following years and lessen the possibility of an overdraft. Overdrafts are largely due to insufficient data available from former years to properly estimate on proposed improvements, or to provide adequate sums for regular annual maintenance charges. Upon the accounting department, with a sufficient staff to keep a unit cost system of all works, will depend, to a great extent, the intelligent administration of a Works Department.

Other sub-departments which the city engineer of a city of 100,000 population generally has to supervise are garbage collections and disposal, building inspection, street cleaning, snow cleaning, workshop and parks. Over each of these sub-departments are superintendents or foremen who report directly either to him or to the deputy engineer.

In the garbage collection the superintendent should also have charge of the stables and work in conjunction with the street superintendent for the placing of horses not needed on the garbage collection during the summer season, when collections are relatively light. The street superintendent has direct charge of the district foremen, constantly going over the city and directing the work of street cleaning and flushing. Incidentally, I may remark that districts should be arranged so that each district foreman has approximately the same amount of pavements, roads, and area to cover, regardless of ward boundaries, thus removing them as much as possible from aldermanic influence and enabling comparisons to be made in their work.

As the cost of an engineering staff sufficient for a city is only 5 per cent. of the cost of the work carried out during the year, it is evidently good business to carry such a staff, but unfortunately, the average small city council does not recognize this, nor does it realize the money lost in carrying out work under incompetent supervision and often without sufficient study of future conditions.

Civic workshops, including machine, blacksmith and woodworking equipments, are a necessity in a city of 100,000 on account of the saving of time in repairs and renewals and the saving of cost of the equipment and plant owned by the city. A storehouse should also be at this workshop for such current supplies as cement, tile pipe, lumber, brick, lead and iron pipe, brass fittings, etc., which are checked out to the foremen as required and charged to the different works by the accounting department from daily reports supplied by the store-keeper.

Excellence of Work Hinges on Foremen

The foremen are the backbone of all work and upon their intelligence and driving ability depends the cost of any work, either on construction, maintenance, or the dfferent civic plants. To assist them and the accounting staff in doing their work in a business-like way the following set of rules was formulated for their guidance.

Ottawa Engineering Department
Rules for Foremen

1.—Your authority to begin work will be in the form of an official work order (blue sheet) issued by the secretary of the Department. **Do not begin work at any time till you receive this order.** This order will either be mailed to you, or delivered to you personally. **Do not start work on anybody's verbal order.** This rule must be strictly obeyed.

2.—Before starting work ask the accountant for requisition and other books and forms.

3.—The storekeepers at the yards are instructed not to give out any supplies except upon the **written requisitions** of foremen. **Foremen who send men to the yards without written requisitions lose time and money.** Such actions will be counted against them.

Upon the accounting department with a sufficient staff to keep a unit cost system of all works will depend, to a great extent, the intelligent administration of a Works Department.

4.—Under no circumstances whatever shall any foreman undertake to order goods direct from a merchant. Goods wanted from merchants must be requisitioned through the accountant on the red ink forms provided for the purpose. In the event of any real emergency, when there is not time to make a formal requisition, the foremen should phone the accountant, who will see that they get the required goods.

5.—Care must be exercised by foremen not to hire men before their job is ready as much money can be wasted in that way.

6.—Foremen are expected to see that the materials for their work are on hand so that the men may not be "standing around." On the other hand, care must be taken to see that materials do not arrive on the job too soon, as loss may be occasioned to unprotected goods from rain or other causes.

7.—When you hire or discharge men, the names of the men you hire or discharge must be reported within 24 hours to the assistant engineer on the printed forms supplied by the Department. As this information is required for office employment records, foremen must be careful when closing down a job not to forget to make their final report of men discharged.

The foremen are the backbone of all work and upon their intelligence and driving ability depends the cost of any work, either on construction, maintenance or the different civic plants.

8.—Foremen's daily reports must be in the hands of the accountant not later than 9 a.m. each day.

9.—All tools, rubber boots, etc., must be requisitioned through the "Yard." This is necessary for our records, as all tools and rubber boots will go back into "stock" at the close of the job. The same rule will apply to lumber, as lumber used for shoring, etc., will be returned to the yard. Cement will also be got from the yard when the order is under 40 bags. **Where 40 bags (or over) are wanted a requisition should be made direct on the office, as waggon loads are delivered direct from the contractor, and save the city haulage.**

10.—The store-keeper has been instructed not to give foremen tools, after the first lot at the start of work, unless the requisition states plainly that the tools wanted are for additional men, or unless equal broken or used-up tools are sent back with the requisition.

11.—**Foremen are expected to "think ahead"** as to what supplies, etc., they will need. Rush orders, due to things being left till the last minute, are objectionable for many reasons. **Any delays on the work caused by non-arrival of "last minute" goods will be held against the foreman.** Allowance will of course be made for genuine emergencies.

12.—Where the job is of sufficient importance to have a member of the engineering staff in charge, the foreman must get the "O.K." of the engineer on all his requisitions.

13.—Foremen must state on their requisitions for what particular use the goods they requisition are wanted. This information is not only necessary for our Accounting Department, but forms a record which may be valuable at a later date.

14.—When the articles asked for have been received, foremen will promptly return to the accountant the requisition receipt form which will be sent from the office. When these receipts are held back, great inconvenience is occasioned both to the Accounting Department and to the merchants.

15.—If you do not receive within a reasonable time the goods you requisition through the office, notify the engineer so that he can get things moving.

16.—It is important that foremen should see that night watchmen do not leave their jobs before they (the foremen) arrive. The foremen must report to the accountant all watchmen who leave their work before 7 a.m.

17.—Attention of foremen is drawn to the fact that when they sign a paysheet they certify that each man on that paysheet has worked the exact number of hours credited to him. Care must therefore be taken that the paysheet is accurate. Paysheets and daily reports must agree.

18.—If by mistake some man is omitted from a paysheet do not try to rectify the mistake by giving him the extra time on the next paysheet. See the Accountant and he will remedy the trouble in a proper manner.

19.—Water works foremen will send their tools to the yard to be sharpened instead of requisitioning through the press house.

20.—Foremen who use cement must insist on their men **handling the bags carefully.** The Department has been losing too much money through the destroying of bags on the jobs. Each torn bag means a loss of ten cents.

21.—The unnecessary use of carts on small jobs must be avoided. A cart is kept at the yard for the convenience of foremen on small jobs.

22.—When a foreman changes his place of residence he should notify the assistant engineer in writing of his new address. Otherwise mailed orders may not reach him on time.

> **The organization of any Works Department is practically the same as that of any other business of the same magnitude, and as it is the big spending department of the city, it requires constant supervision to get as much as possible for the money of the citizens.**

23.—Foremen must notify the accountant when their jobs are about to wind up. Twenty-four hours advance notice should be given. This is to permit the accountant if desired to have a special office check made at the yard, of the returned tools and plant. In any event advance notice is required to permit the storekeeper at the yards to make his plans for receiving the tools.

24.—When a foreman moves direct from one job to another, taking his tools with him, he must similarly phone the engineer twenty-four hours ahead of his readiness to move.

25.—When a job is finished the foreman must promptly return his "work order" to the accountant with a statement of his time and material as per the forms provided on it for the purpose.

26.—**Loaning of tools or supplies between foremen is forbidden.** As foremen are held responsible for all tools and supplies put in their charge, such a practice is liable to lead to trouble. As stated in a previous paragraph foremen are expected to "think ahead" and not let themselves run out of supplies or tools. Should ordered goods not arrive when expected foremen must not borrow. Their remedy is to phone the engineer.

From the foremen and timekeepers comes information as to the daily amount of all work done with the number of men and teams employed and other details which the following day are placed before the city engineer so that he can see at a glance the daily progress of any work and the approximate cost to date. Thus he is in a position to detect any faults or lack of progress before it is too late and this is about the most efficient method of keeping track of various works distributed throughout the city, combined, of course, with a daily personal inspection when possible.

Works Department Like a Business

The organization of any Works department is practically the same as any other business of the same magnitude, and as it is the big spending department of a city it requires constant supervision to get as much as possible for the money of the citizens, especially when it is remembered that the city engineer is working under conditions that do not hold in private corporations. With his organization, however, as outlined and a unit cost system on the different works, the city engineer can get about a seventy per cent. efficiency. It should be realized that in most cities the biggest business in the city is the city's business, and upon the efficiency of the city's department of Works will depend the tax rate and the financial standing of the municipality.

> **The biggest business in the city is the city's business and upon the efficiency of the city's Department of Works will depend the tax rate and the financial standing of the municipality.**

Specifications Submitted for Approval

At a recent meeting of the American Engineering Standards Committee, five standard specifications were submitted by the American Society for Testing Materials for approval of "American Standards." These are:—

(1) Standard specifications for drain pipes;
(2) Standard test for toughness of rock;
(3) Standard test for penetration of bituminous material;
(4) Standard method for distillation of bituminous materials suitable for road treatment.
(5) Standard method for sampling coal.

Border Housing Co.'s Programme

The Border Housing Company, Limited, has been formed at Walkerville, Ont., for the erection of houses to be sold to employees of the various industries of the Border Cities. The programme is to erect one hundred houses during the coming season. Mr. H. Bryan Gilbert has been appointed architect to undertake the work. He will be pleased to receive manufacturers' samples and catalogues, addressed to him at Walkerville.

Water Purification and Its Relation to State Sanitation

Impure Water Supplies a Cause of Epidemics of Enteric Diseases—Greater Knowledge of Bacteriology Has Led to a Movement for More Effectual Sanitary Measures —Result is Evident in the Greatly Decreased Typhoid Mortality Rate

By F. A. Dallyn, B.A.Sc., C.E., Sanitary Engineer, Provincial Board of Health of Ontario

The general health of a community is largely dependent upon the quality of its water supply. How true this is, is evident from the disastrous epidemics that, at various times, have followed the consumption of impure or polluted water. Purification of a water supply is, therefore, an essential to good health. Recent investigations have suggested that other diseases than typhoid are associated with water impurity and that a reduction in the typhoid rate means improvement in the general mortality rate. Working along these lines, the province of Ontario has accomplished results that place her in a leading position so far as typhoid reduction is concerned. With a mortality from this disease last year of only 5.6 per 100,000 as compared with 31.5 ten years ago, Ontario may be said to be making big strides in sanitation, an accomplishment due to the vigorous efforts of the Provincial Board of Health.. This important work of improving the province's health is referred to in the article below by F. A. Dallyn, provincial sanitary engineer of Ontario, who, under the topic "Water Purification and Its Relation to State Sanitation", discusses in general terms the great significance of pure water.

THIS subject was suggested to the writer as a part of that larger problem, the consideration of the eventful roles taken by the great public utilities and municipal improvements of our western civilization in the modern drama of preventive medicine. In discussing all such problems, important factors not to be lost sight of are the characteristics of national life, characteristics which are racial and especially those having to do with living conditions. These may greatly modify conclusions suggested from the published mortality statistics of state or provincial bureaus.

The role generally given to water purification,—eradication of typhoid fever—is a most important one to the sanitarian of the North American continent. There are several interesting text books which amplify this fact, notably "Typhoid Fever" by Prof. Geo. C. Whipple, "Value of Pure Water" by Whipple, "Clean Water and How to Get It" by Allen Hazen, and "Water and Public Health" by Fuertes.

Association of Water Supply With Disease Was Formerly Conjecture

Prior to the development of the science of bacteriology, the association of water with enteric diseases was largely conjecture from coincidences of the prevalence of disease and the use of water of a particular source. This is very well shown in the history of an Asiatic cholera outbreak in London, England, 1854, which was traced to the pollution of the Broad Street well, and which has been recorded as follows:

*(Report of Cholera Inquiry Committee.) Dr. John Snow's testimony: "I requested permission on the 5th of September, to take a list, at the General Register Office, of the deaths from cholera registered during the week ending the 2nd of September in the subdistricts of Golden Square and Berwick Street, St. James' and St. Anne's, Soho. Eighty-nine deaths from cholera were registered during the week in the three subdistricts. Of these only six occurred on the first four days of the week; four occurred on Thursday, Aug. 31st; and the remaining 79 on Friday and Saturday. I considered therefore, that the outbreak commenced on the Thursday; and I made inquiry in detail respecting the 83 deaths registered as having taken place during the last three days of the week.

"On proceeding to the spot I found that nearly all the deaths had taken place within a short distance of the pump in Broad Street. There were only ten deaths in houses situated decidedly nearer to another street pump. In five of these cases the families of the deceased persons told me that they always sent to the pump in Broad Street, as they preferred the water to that of the pump which was nearer. In three other cases the deceased were children who went to school near the pump in Broad Street. Two of them were known to have drunk the water, and the parents of the third think it probable that he did so. The other two deaths beyond the district which the pump supplies represent only the amount of mortality from cholera that was occurring before the eruption took place.

Disease Traced to Water of One Source

"With regard to the 73 deaths occurring in the locality belonging, as it were, to the pump, there were 61 instances in which I was informed that the deceased persons used to drink water from the pump in Broad Street, either constantly or occasionally. In six instances I could get no information, owing to the death or departure of everyone connected with the deceased individuals; and in six cases I was informed that the deceased did not drink the pump water before their illness.

"The result of the inquiry consequently was that there had been no particular outbreak or increase of cholera in this part of London, except among persons who were in the habit of drinking the water of the above-mentioned pump well.

"The additional facts that I have been able to ascertain are in accordance with those above related; and as regards the small number of those attacked who were believed not to have drunk from the Broad Street pump, it must be obvious that there are various ways in which the deceased persons may have taken it without the knowledge of their friends. The water was used for mixing with spirits in some of the public houses around. It was used likewise at dining rooms and coffee houses. The keeper of a coffee-shop which was frequented by mechanics, and where the pump water was supplied at dinner time, informed me on the 6th of September that she was already aware of nine of her customers who were dead."

On the other hand Dr. Snow discovered that while a workhouse (Almhouse) in Poland Street was three-fourths surrounded by houses in which cholera deaths occurred, out of 535 inmates of the workhouse only five cholera deaths occurred. The workhouse, however, had a well of its own in addition to the city supply, and never sent for water to the Broad Street pump. If the cholera mortality in the workhouse had been equal to that in its immediate vicinity it should have had fifty deaths.

A brewery in Broad Street employing seventy workmen was entirely exempt, but having a well of its own, and allowances of malt liquor having been customarily made to the employees, it appeared likely that the proprietor was right in his belief that resort was never had to the Broad Street pump.

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*Extract appearing in Sedgewick's Principles of Sanitary Science and the Public Health.

It was quite otherwise in a cartridge factory at No. 38 Broad Street, where about two hundred work people were employed, two tubs of drinking water having been kept on the premises and always filled from the Broad Street well. Among these employees eighteen died of cholera. Similar facts were elicited for other factories on the same street, all tending to show that in general those who drank the water from the Broad Street well suffered either from cholera or diarrhoea, while those who did not drink that water escaped.

Detailed Studies of Broad Street and Its Pump

In addition to the original and general inquiry conducted from the time of the outbreak by Dr. Snow, the Rev. H. Whitehead, M.A., curate of St. Luke's in Berwick Street, and like Dr. Snow a member of the Cholera Inquiry Committee, whose knowledge of the district both before and during the epidemic, owing to his official position, gave him unusual advantages, made a most elaborate and painstaking house-to-house investigation of one of the principal streets affected, viz., Broad Street itself. Mr. Whitehead's detailed investigation supplies most interesting and important confirmatory evidence of Dr. Snow's theory that the Broad Street well was the source of the epidemic. Mr. Whitehead, moreover, went further than Dr. Snow, and endeavoured to find out how the well came to be infected, why its infectious condition was so limited as it appeared to have been and to answer various other questions which occurred in the course of his inquiry. As a result he concluded that the well must have been most infected on August 31; that for some reasons unknown a partial purification began on September 2nd, and thereafter proceeded rapidly. There was some evidence that on August 30th the water was much less infected than on August 31st, so that its dangerous condition was apparently temporary only. He further discovered that in the House No. 40 Broad Street, which was the nearest house to the well, there had not only been four fatal cases of cholera contemporaneous with the epidemic, but certain earlier cases of an obscure nature, which might have been cholera, and that dejecta from these had been thrown without disinfection into a cesspool very near the well. On his reporting these facts to the main committee, Mr. J. York, secretary and surveyor to the committee was instructed to survey the locality and examine the well, cesspool and drains at No. 40 Broad Street.

Survey and Description of the Broad Street Well and Its Surroundings

Mr. York's report revealed a startling condition of affairs. The well was circular in section, 28 ft. 10 in. deep, 6 ft. in diameter, lined with brick, and when examined, contained 7 ft. 6 in. of water. It was arched in at the top, dome fashion, and tightly closed at a level 3 ft. 6 in. below the street, by a cover occupying the crest of the dome.

The bottom of the main drain of the house No. 40 Broad Street lay 9 ft. 2 in. above the water level, and one of sides was distant from the brick lining of the well only 2 ft. 8 in. It was "constructed on the old fashioned plan of a flat bottom, 12 in. wide, with brick sides rising about 12 in. high, and covered with old stone. As this drain had but a small fall, or inclination outward to the main sewer, the bottom was covered with an accumulation of soil deposit about 2 in. thick; and upon clearing this soil away the mortar joints of the old stone bottom were found to be perished, as was also all the jointing of the brick sides, which had brought the brick work into the condition of a sieve, and through which the house drainage water must have percolated for a considerable period.

"After opening back the main drain, a cesspool intended for a trap, but misconstructed, was found in the area, 3 ft. 8 in. long, by 2 ft. 6 in. wide, and 3 ft. deep; and upon or over a part of this cesspool a common open privy (without water supply), for the use of the house, was erected, the cesspool being fully charged with soil. This privy was formed across the east end of the area, and upon removing the soil, the brickwork of the cesspool was found to be in the same decayed condition as the drain, and which may be better comprehended by stating that the bricks were easily lifted from their beds without any force; so that any fluid could easily pass through the work, or, as was the case when first opened, over the top course of bricks of the trap, into the earth or made ground immediately under and adjoining the end wall eastward, this surface drainage being caused by the accumulation of soil in, and the misconstruction of, the cesspool.

Percolation of Sewage into Well

"Thus, therefore, from the charged condition of the cesspool, the defective state of its brickwork, and also that of the drain, no doubt remains upon my mind that constant percolation, and for a considerable period, had been conveying fluid matter from the drains into the well; but lest any doubt should arise upon this subject hereafter, I had two spaces of the brick steining, 2 ft. square each, taken out of the inside of the well—the first, 13 ft. deep from the level of the street paving, the second, 18 ft. deep, and a third was afterward opened still lower, when the washed appearance of the ground and gravel fully corroborated the assumption. In addition thereto the ground was dug out between the cesspool and the well to 3 ft. below the bottom of the former, and its black, saturated, swampy condition clearly demonstrated the fact, as did also the small furrowed appearance of the underlying gravel observed from the inside of the well from which the fine sand had been washed away during the process of filtration."

Dr. John Snow in 1854, gave it as his opinion that not only wells but also public water supplies of far more general distribution, such as those furnished by cities or corporations and derived from rivers, may, under certain circumstances, be carriers of cholera. The great epidemic of Asiatic cholera in London in 1832, 1848-1849 and 1853-1854 had so strongly enforced this idea that in dealing with an important problem raised by epidemic cholera in London in 1866 Mr. J. Netten Radcliffe states that "The predominant lesson derived from the outbreaks of 1848-1849 and 1853-1854 was that the localities of chief prevalence of the disease were mainly, if not solely, determined by the degree of impurity of the water supply."

American Water Supplies Often Polluted by Sewage

The growth of public utilities, especially the extension of waterworks systems and main drainage in Great Britain, Continental Europe and in North America, naturally followed the movement of population to urban centres. The inadequacy of well water supply for our great industries needs no elaboration.

Industrial expansion in Great Britain and Continental Europe preceded the remarkable industrial development of the North American Commonwealths. The situation with reference to the available supplies of water was not similar in the two continents. Waterborne enteric fevers were the exception in Europe. The principal transmission was through other agencies, of which the common house fly and infected food other than public water supplies account for the greater portion.

The American industrial expansion had therefore no lesson to learn from the European experience with reference to the development of our great public utility—municipal water supply. With few exceptions water supplies in the latter are obtained either from upland lakes and pure streams or from underground sources. In America the case is different. The great industrial centres, almost without exception, are located upon a network of great waterways, which stretch across that continent, east and west, and north and south. Unfortunately almost without exception the great streams and lakes which lap the wharves of the American communities which carried the early commerce became the first sources of water supply. The natural purity was such that these supplies when first introduced were used without treatment whatsoever. As the industrial areas grew and developed, great sewer systems became necessary, and the waters, acting as sources of water supply, also became the recipients of the sanitary drainage. Their pollution in the neighborhood of towns and cities was slow and insidious.

You ask why such conditions were tolerated or allowed to continue. There seems to be two very good reasons; first, the industrial development was so unprecedented that the country lost its head temporarily and sacrificed all to this new God of Mammon. Second, there was insufficient advance in the art of preventive medicine to warn communities of the insidious danger of the ever increasing sewage pollution in their water supplies.

It was not until 1880 that the organism causing typhoid was discovered in the spleen and diseased areas of the intestines in typhoid cadavers and not until some years later was the true significance of sewage pollution in relation to typhoid fever realized. Connected steps in bacterial study of our streams pollution was not therefore possible until 1884, and it is only since 1905 that the test for the colon group, the presence of which is taken as evidence of sewage pollution has been in common use by our public health laboratories.

Reduction of Typhoid Death Rate

A movement for improvement of water supplies in the United States of America naturally followed the laboratory findings but was handicapped by an uninformed public and it is a remarkable thing that even as late as the year 1910 less than 10 per cent. of the population in cities was supplied with filtered water*; the typhoid fever rate at this date—1910—in cities was 23.7 per 100,000 population; in 1915 when approximately 29.36 per cent. of the supplies were filtered and 54.2 per cent. disinfected by chlorine, the rate had dropped to 11.5 per 100,000, a fifty per cent. reduction. In 1917 the rate was further reduced to 10.7 and in 1918 the general typhoid rate for the whole of the registration area had been reduced from 23.5 per 100,000 of population in 1910 to 12.4 per 100,000 in 1918.

In Canada much the same conditions hold as for the United States, the province of Ontario being particularly affected by the prevalence of disease in the state of New York and the states of the middle west, most probably due to the wonderful flow of population back and forth across the boundary. Improved legislation was granted the Provincial Board of Health in 1912 and a renewed effort to improve the existing water supplies was undertaken. By the end of 1913 the principal suspected foci of typhoid fever dissemination were subjected to rigorous control with the consequences that the deaths from typhoid fever have been reduced over 500 per annum between the years 1910 and 1918, the average death rate in cities throughout the province being reduced from 51.5 per 100,000 in 1910 to 5.6 per 100,000 in 1919, a reduction of over 89 per cent.

Some writers claim that they have been able to show coincidences in statistics in substantiation of the claim that a reduction in typhoid fever is attended with a general reduction in the mortality rate. If one agrees that one death from typhoid is associated with fifteen to twenty cases of illness, one can readily appreciate that they have very substantial ground on which to stand.

Other Causes Than Water Need Attention

The problem which engages one's attention now is whether purification of water supplies to the exclusion of other measures is in itself sufficient to eradicate typhoid fever. There seems to be some ground for this claim for the province of Ontario, as in Ontario there is very little typhoid fever in the rural parts of the province. In the United States this is not true and the high rural rates together with the abnormal rates amongst the coloured population leads one to echo Professor Whipple's pronouncement that "while the care of water supplies cannot in any way be relaxed, efforts for further reducing the disease—typhoid fever—must be directed to causes other than water."

In conclusion, what has been said with reference to the eradication of typhoid fever by the purification of municipal water supplies is equally true of the eradication of certain other members of the enteric fever group. Typhoid fever has been selected as the outstanding member of the group and the one best demonstrating the relation of water purification and the public health.

Report on Corrosion Tests

WITH a view to determining whether or not the presence of lime in mortars and other building materials prevents the corrosion of metal used as reinforcement, the chemical laboratory of the National Lime Association has recently made up slabs of various materials used in building operations both without lime and with varying quantities of lime in which polished steel rods are imbedded. In one series the slabs are cured for different periods in air only, while in duplicate series they are immersed at regular intervals in water for five-minute periods.

The thirty-day breaks have been made on corrosion test slabs of the following materials:

Lime plaster (high calcium and high magnesium)
1-2-4 Concrete without lime.
1-2-4 Concrete with 5 per cent. lime.
1-2-4 Concrete with 10 per cent lime.
1-2-4 Concrete with 15 per cent. lime.
Gypsum without lime
Gypsum with 5 per cent. lime.

The air-cured gypsum slab showed practically the same amount of corrosion of the steel rods as in the case of the two-week break, while the slab which had been dipped in water showed a considerable increase in the amount of corrosion. In the case of gypsum containing lime no corrosion was visible in either the air or water-cured sample.

Typhoid Fever Death Rate per 100,000 of Population

Showing Prevailing Rates in Continental Europe and United States of America

	1919	1918	1917	1916	1915	1914	1913	1912	1911	1910	1909	1908	1907	1906	1905	1904	1903	1902	1901	1900
Prov. of Ontario	....	7.52	8.4	12.05	10.7	18.5	16.7	18.7	25.3	31.5	29.9	29.7	23.4	40.5	20.2	21.9	17.8	17.7	23.0	29.3
United States	....	12.4	13.4	13.3	12.4	15.4	17.9	16.5	21.0	23.5	21.1	24.3	29.5	31.3	27.8	31.7	34.1	34.3	32.3	35.9
Eng. & Wales	....	....	....	....	3.9	4.6	4.1	4.4	6.7	5.3	6.0	7.6	6.7	9.2	9.0	9.4	10.0	12.6	15.5	17.4
Germany	....	....	....	....	....	....	2.9	3.2	4.9	4.0	4.2	4.7	4.9	5.7	6.2	6.9	6.9	6.5	10.0	10.5
France	....	....	....	....	....	....	....	....	13.1	8.0	9.8	12.3	13.1	13.9	5.5	6.8	7.1	7.0	7.3	10.8
Denmark	....	....	....	....	....	.8	.6	.8	.8	1.1	1.6	2.2	1.4	1.3	1.9	1.7	2.3	2.0	5.3	3.5

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*Dr. Cressy L. Wilbur, chief statistician for vital statistics, Bureau of the Census, U. S. A., stated in the preface to Mortality Statistics, 1911: The mortality from typhoid fever in the United States is still far in excess of that of progressive European countries; if it could be reduced by three-fourths, so that it would be only five per 100,000 as in England and Wales, the Netherlands and Prussia for 1910, it would represent a saving of nearly ten thousand lives, (annually) at the period of their greater usefulness as a rule, in the registration area alone.

The Future of Contracting Depends on an Organized Industry

The Work and Aims of the Association of Canadian Building and Construction Industries

By J. Clark Reilly, General Secretary A.C.B.C.I.

"AN analysis of income tax returns shows that contracting is the most hazardous industry in the country. They show that the amount of loss for every dollar of profit made by construction corporations is eight times as great as it is in manufacturing, agriculture, or personal service corporations; five times as great as in transportation and public utility corporations; over three times as great as in mining and quarrying; and nearly twice as great as in banking.

"The reasons for this condition are due to the unusual number of doubtful elements in construction with which a contractor must work. It is unnecessary to enumerate them. They are all too familiar. It is sufficient that the more such uncertainties can be eliminated, the lower will be the cost of construction to the owner, the more satisfactory will be the relations of the architect, the engineer and the contractor, and the more will contracts be awarded on a basis of skill, integrity and responsibility. Never was this more true or action on it more needed than at the present time."

The foregoing statement, quoted from a prominent American authority in the construction industries, applies equally to conditions existing in Canada, and furnishes us with one of the principal reasons for the formation of a Canadian association of the building and construction interests. One of the best measures to stabilize the industry is to bring those connected with it into close relationship, and furnish a common ground for discussion and action. In both the conferences which have been held, in November, 1918, when the Association of Canadian Building and Construction Industries was organized, and in February, 1920, the need for such stabilization has been strongly emphasized.

Contractors Have Been Too Individualistic

It is an admitted fact that members of the construction industries have been far too provincial and individualistic. The system of competitive bids with fixed price for contract has tended to encourage this attitude, and increase the uncertainties of construction. But in recent years there has been some evidence of a change. In several of the most progressive countries of the world, at practically the same time, the idea seems to have gained ground that the construction industry was suffering from a lack of organization, and efforts have been made to remedy the defect. The conditions subsequent to the war have probably hastened the movement. We found, in organizing our Association, that we were working along practically identical lines with our brothers in the industry elsewhere.

The Association of Canadian Building and Construction Industries stands, therefore, as an effort to unify those engaged in the construction industry in Canada. The ideal method would have been to have organized local societies in each city, then have these organized into provincial bodies with a Canadian executive governing them all. Conditions already existing made it necessary to proceed in a rather different direction, for in a number of cities there were societies of builders already in existence, but in only two provinces were there provincial organizations making an effort to combine the local organizations. Consequently, the work of organization has gone slowly at first, and it has been necessary to incorporate a Canadian body, and work with it as a basis, endeavoring to secure the allegiance of the provincial and local organizations. In this direction both the Provincial Builders' and Supply Association of Ontario and the Associated Builders' Exchanges of Saskatchewan have gone on record at their last annual general meetings as expressing their affiliation with the Canadian Association, and have each elected three provincial councillors to the national council.

A number of the existing local associations have taken out "collective" memberships, and in several cities where no builders' organization was already in existence, branches of the Association have been formed.

A Greater Need for Unity Than Ever

The need for greater unity in the construction industries of Canada is becoming more apparent every day. To the careful student of conditions, it is evident that the problems which worry the builder, the contractor, the sub-contractor and the supply-man in Edmonton and Vancouver are in the main the same as those which keep his fellow-constructionist awake nights in Montreal, St. John, Toronto or Halifax. Fluctuation of prices, difficulties of transportation, uncertain weather conditions, changes in plans, financial obligations, unforeseen conditions, cost of equipment, labor troubles and many other similar worries are common to us all. A common meeting ground where these can be discussed will be furnished by the general conferences of the Association and the national council meetings.

The Association also furnishes a medium for communication with the government, and with the representatives of organized labor. It has been very apparent, during the past year, that labor is making the strongest efforts toward the unification of labor laws throughout the Dominion. The questions of the eight-hour day, minimum wage, and workmen's compensation acts are of vital concern to our industry, and to secure the best legislation, which will at the same time protect our interests and give labor a fair deal, we need to present a strong and united front. There will be the necessity for strong provincial organizations, to deal with these matters as they arise in the provincial legislatures, but the new conditions demand also that our industry shall be adequately represented in proposed Dominion legislation.

The success, therefore, of an Association such as ours depends upon two chief factors, namely, the service it renders to the industry, and the support it receives. In endeavoring to fulfil the first of these, we have been working along several lines and will extend our scope of operations just as rapidly as the support received warrants the additional expenditures.

The office of the secretary is situated in Ottawa, in the Commercial Chambers, Sparks Street, and is intended to be a "service station" for the industry. Members are encouraged to write or wire inquiries regarding proposed legislation or information which they wish obtained from the governmental offices or the Department of Labor. Much valuable work has already been done in this way. It is also planned to keep a close watch on legislation affecting our industries as it is introduced, reporting same to the members throughout the country, and securing their co-operation in what action may be deemed necessary. As the opportunity arises, information will be sent out from the secretary's office to the members, in the form of "service letters."

Aiming to Adopt a Standard Contract

At the present time, the Association has two very important standing committees engaged in the consideration of matters affecting the industry throughout Canada. One of these is the Committee on Standard Practices, under the chairmanship of H. T. Hazelton, president of the Winnipeg Builders' Exchange. It is considering the problem of a satisfactory standard contract, which ought to be one of the simplest means to eliminate some of the uncertainties existing today in construction work. The aid of the Engineering Institute of Canada has been enlisted in the committee's deliberations, and representatives are being appointed by both of these bodies. It is worth noting here that a similar committee appointed by the Associated General Contractors of America, has made a study of 113 forms of contracts of various types during the past year. Their committee is not yet prepared to submit a complete form of contract embodying every provision which should be included in a good contract, but have submitted some very interesting provisions. From this it will be seen that our committee has no small task on its hands, and any suggestions which may be given it by members of the industry will be appreciated.

The other standing committee was appointed to consider problems relating to labor, and consists of fourteen members, under the chairmanship of Mr. J. P. Anglin, Montreal. It is engaged in considering questions including: Responsibility of labor unions, annual agreements, apprenticeship, technical education, grading and classification of workmen, immigration of labor, eight- and nine-hour day, and standardization of wages. The Minister of Labor and the leaders of labor connected with the Canadian building industries have expressed their willingness to co-operate in discussion of these and other important matters.

We believe that the next few years will see great advances in the construction industries of our country, but the problems which will confront us will demand our utmost effort and united action. The Association of Canadian Building and Construction Industries is an endeavor to meet the situation, and therefore requires the support and co-operation of every Canadian builder, contractor, sub-contractor and supply-man in its work.

Chlorination as a Means of Disinfecting Municipal Water Supplies

By G. G. Nasmith, C.M.G., Ph.D., D.Sc., D.P.H.*

The name of Dr. Nasmith attached to this article is sufficient to stamp it with authority. Dr. Nasmith, who is a widely recognized expert on sanitation matters, has devoted many years of his professional practice to the study of water purification and municipal sanitation. An article from his pen, therefore, on the subject of chlorination can be considered as containing the last word to be written on a topic that is of interest to every municipal and waterworks official. The topic is here developed comprehensively and with that authority and assuredness on the part of the author that only many years of original research work could give him. Dr. Nasmith's record is well known and especially his war service. Through his outstanding work with the forces of the Allies in connection with sanitation, he was invested with the companionship of St. Michael and St. George. As soon as he completed his war service, he engaged again in the investigation of problems of sanitation including water and sewage purification. Dr. Nasmith's researches have been recorded in writings which have been widely published.

THOUGH the value of chlorine as a disinfectant had long been recognized, it was in 1897 that it was first used to disinfect the water and the water pipes of a municipal supply after a typhoid fever epidemic in Maidstone, England. In that case a solution of chloride of lime was added to the water pumped, and the inhabitants of the town were notified to open their faucets so that the whole system would be thoroughly washed out with the disinfecting solution.

Dr. A. C. Houston (now Sir Alexander Houston), of the Metropolitan Water Board of London, England, was the first to systematically disinfect a municipal water supply, when in 1905 he treated the water of Lincoln, England (population 50,000), with 'Chloros,' an alkaline solution of sodium hypochlorite. The amount of available chlorine there used was one part in a million. Since then the method has come into general use, particularly in America, for disinfecting public water supplies.

Chlorination is now generally accepted as a cheap and easily installed process of disinfecting a drinking water supply. Many troubles have occurred from the employment of slapdash methods and carelessness in application, resulting in objectionable tests, in over-chlorination and in under-chlorination; nevertheless the method is generally accepted as one which, though by no means an ideal one, has been extremely useful in controlling water-borne diseases.

The first practical bacteriological results obtained from the use of minute amounts of chlorine as a disinfectant of water were probably those obtained by Kanthack in 1898, when he showed that 0.3 to 0.36 parts of available chlorine to one hundred thousand parts of sewage effluent reduced the number of bacteria from innumerable to fifty per cubic centimetre. The word 'disinfection' is used rather than 'sterilization' because it has been generally found that common bacteria spores are not destroyed, while the vegetative forms are rapidly killed.[1] Fortunately all of the pathogenic bacteria, such as typhoid, cholera and dysentery bacilli, are readily killed by chlorine. Nasmith and Graham[2] in 1909 showed that 0.15 parts of free chlorine to a million parts was sufficient to completely destroy typhoid bacilli, dysentery bacilli and colon bacilli in ten minutes in Great Lakes water.

Dr. G. G. Nasmith, C.M.G.

Forms of Application

The chlorine available for disinfection of water supplies may be obtained from calcium hypochlorite, liquid chlorine gas or electro-bleach, and may be applied at any point before or after pumping. In the early days, calcium hypochlorite, commonly known as chloride of lime, was the agent chiefly used, and is today frequently employed, either alone or as a stand-by in case the liquid form of apparatus fails. It has now, however, been largely superseded by liquid chlorine installations, chiefly because this process is labor saving, is easy of operation, and is free from objectionable odors. The liquid chlorine apparatus should always be installed in duplicate in case of a break down in the operating unit. It is curious to reflect that municipal authorities are frequently quite willing to take a chance with a dangerous municipal water supply by installing only a single liquid chlorination unit, and trusting to luck. The extraordinary rise in the price of the liquid chlorine apparatus may have something to do with the reluctance of authorities to buy more machines.

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*Gore, Nasmith and Storrie, Consulting Engineers, Toronto, and Ex-Director of Laboratories, Department of Public Health, Toronto.

[1] The Resistance of Certain Bacteria to Calcium Hypochlorite. Journal, American Public Health Association, Wesbrook, Whittaker and Mohler, February, 1911.

[2] A Simple Method of Purifying Almost Any Infected Water for Drinking Purposes. Journal Royal Army Medical Corps, July, 1911.

The third, or electro-bleach, method, has some desirable features, and it is not unlikely that it may yet come to the front on account of its cheapness and general applicability. Shenton[3], in 1910, adopted this method to sterilize the water in a mining area in India. The apparatus consists of an electrolyser in which an electric current is passed through a solution of common salt in water. The electrolytic sodium hypochlorite formed is then drawn off and mixed at once with the water to be treated, the Venturi meter, if necessary, being used to control the dosing apparatus.

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In almost all cases, the chlorine solution, whether obtained by dissolving chlorine gas in water or from hypochlorite of lime or electro-bleach, is mixed with the water before it reaches the pumps. In some cases chlorine gas is allowed to pass through porous plates or diffusers, and is absorbed directly by the water flowing to the pumps. Usually, however, the chlorine is dissolved in water and the solution is distributed as evenly as possible over the whole cross-section of pipe or tunnel in order to allow as thorough a mixing as possible of the chlorine and water before the pumps are reached. In the pumps a further mixture is effected and in practice this churning is usually found sufficient to distribute the chlorine evenly throughout the water.

Difficulties With Chlorine Disinfection

Naturally there are difficulties in connection with the application of chlorine which are inherent to the various forms of apparatus. In using calcium hypochlorite mixture there is always the objection to the dust which irritates the mucous membrane of the nose and throat. Since comparatively large tanks are necessary to hold the mixed hypochlorite solution, more space is required than is necessary for a liquid chlorine installation. The float used in the constant head tank tends to get out of order. There is also a certain disadvantage in the hypochlorite of lime system due to the fact that the bronze orifices slowly become clogged with lime salts, while the pipe conducting the solution to the water supply and the grid which distributes the solution across the incoming stream, unless frequently cleaned, fill up and become plugged.

In a liquid chlorine installation, breaks of the apparatus may occur, while leaks occasionally develop in spite of the fact that all parts exposed to the chlorine gas are made of resistant material. One of the most difficult features in connection with a liquid chlorine installation is to obtain a conducting pipe for the mixed chlorine solution and a grid that will not corrode. Rubber pipe is commonly used inside of an iron pipe and is fairly satisfactory, but the grid itself usually causes trouble. The greatest difficulty experienced in connection with the Toronto system has been to distribute the chlorine evenly across the stream of water flowing to the pump. We found there that the water drawn through one pump at the main pumping station was frequently much higher in free chlorine than that drawn from another, in spite of the fact that the intakes of both pumps were from the same stream which had already been chlorinated. The difficulty was to break up the incoming stream of chlorine solution into very numerous streams and distribute these evenly throughout the cross section of inflowing water, so that every drop was treated.

Field Methods of Chlorinating Water

The value of chlorine in disinfecting water on a small scale has been thoroughly demonstrated during the last ten years. The method of Nasmith and Graham was the first to be generally employed, and is even yet the simplest and most accurate. It was designed for the purpose of enabling prospectors, miners and soldiers to disinfect small quantities of water, such as a pailful, and consisted of making a stock solution of hypochlorite of lime, by rubbing up a level teaspoonful of the powder in four cupfuls of water. This stock solution was of such a strength that one teaspoonful, thoroughly mixed with a pail of water, would provide 0.5 parts of available chlorine per million, and proved in practice to be very effective. The method was widely published by the Provincial Board of Health of Ontario, was adopted in several of the States of the Union, and was copied all over the English speaking world.

In the British army during the war, a method recommended by Prof. Simms Woodhead was used. It consisted of adding a measured quantity of dry hypochlorite of lime powder to the water in the standard army water cart. A spoon of known capacity was enclosed in each small can of hypochlorite of lime powder, and a device for determining the amount of chlorine required for any given water was issued, so that the man in charge of the water cart in dealing with a new source of supply could readily determine whether one, two or more spoonfuls of the hypochlorite powder should be employed to disinfect the contents of the cart. This army method of disinfecting water in the field proved to be quite effective, the general practice being to half fill the cart, dump the powder in and then complete the filling. By the time the cart had reached its destination, agitation was usually sufficient to distribute the chlorine throughout the mass of water, and very frequently upon test a residual amount of chlorine was obtained in samples ex-

General experience has proved that, with proper control, chlorine, in any of its available forms, has been an exceedingly valuable agent in helping to eliminate enteric disease. The installation is cheap, the treatment is effective, and as long as properly supervised, and breaks in its continuity prevented, it can be depended on. Even though there are difficulties in application and in the development of tastes, and though it is dependent on the human element, it is nevertheless an exceedingly efficient and reliable process, and one of the greatest discoveries that sanitarians have made during the last century.

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[3] Purification of the Water Supply of Indian Collieries. By H. C. Shenton, "Colliery Guardian," December, 1910.

amined on the spot. The writer found that when the man in charge of the water cart and the medical and sanitary officers responsible for the safety of the water supply knew that samples of water were liable at any time to be examined, either in the field or in the laboratory, it had a very salutary effect in maintaining the efficiency of the system.

In many areas in the British army, the water was filtered and then chlorined in special motor filter units originally designed and brought before the British War Office by the writer. Some of these mobile filters of the barge type were even floated up canals to the fighting front, and the water, which passed through them, was pumped for many miles into stand pipes in the surrounding area for the supply of the army. Chlorination of potable waters was generally adopted in the French and American armies also.

Filtration and Chlorination

Since the advent of chlorine as a sterilizing agent, our view-point as to the importance of filtration has been somewhat modified. At one time the value of any filter was gauged by its bacterial efficiency: that is, its ability to remove the largest percentage of bacteria. There was a constant feud between the advocates of slow sand filtration and mechanical filtration, the former usually having the best of the argument because they could prove a higher removal of bacteria; and since the removal of bacteria was the vital thing from the health standpoint, slow sand filters were usually considered to be safer. At the present time, whether a filter removes a few per cent. more or less of the bacteria present in the raw water is not of vital importance because we know that chlorine will take care of any bacteria present in the clear effluent. Such high bacteria efficiencies are, therefore, not striven for to the same extent as in former years.

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All dirty and turbid waters, which practically means all surface waters, should undoubtedly be filtered, even though the tendency among certain people is to view the filter as an auxiliary agent rather than the chief agent to make an unsafe water safe for drinking purposes. The almost universal use of chlorine to disinfect the effluent from a filtration plant is in itself evidence that filters in themselves are not considered to be altogether adequate for the purpose of completely purifying a water supply. It is customary to filter water first and chlorinate it afterwards, though there would appear in many cases to be no serious objection to adding chlorine with the coagulant in mechanical filters. Of course, chlorine, other than in minute quantities, must not be added to water passing through slow sand filtration beds, as a great excess would soon destroy the biological function, and therefore the efficiency, of these beds. The amount of chlorine required to treat filtered water is usually less than that demanded by raw water, presumably because of the removal of organic matter by the filtration process.

Amounts of Chlorine Required by Different Waters

The quantity of chlorine required by different waters varies tremendously. The Great Lakes waters require only from 0.125 to 0.35 parts per million, depending on the season and on the amount of pollution present. Well waters as a rule also require only minute amounts, but surface waters, particularly brown waters, those of a peaty nature, or those containing the wastes from mines, mills and towns, require very much larger quantities. Thus I found that more than one part per million was necessary to disinfect the darkly stained Valcartier River water at the Valcartier military camp in Quebec.

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Many rivers change in character from hour to hour, so that the quantity of chlorine required for disinfection may vary very rapidly. Consequently efforts have been made to determine the quantity of chlorine required for the disinfection of water from its oxygen consuming power. A considerable amount of work has been done along this line. Here again it depends on the nature of the organic or inorganic material present. Hydrogen sulphide and similar materials will very rapidly exhaust the available chlorine, which may be used up before its full bactericidal effect has been exerted. On the other hand, the amount of organic matter present may not seriously affect the bactericidal action of chlorine. This was well illustrated in Toronto a few years ago when some twenty million gallons of fresh domestic sewerage a day was disinfected with chlorine before it reached the sedimentation tanks. We found that six parts per million of available chlorine reduced the total number of bacteria and also the number of red colonies by 99.5 per cent. in half an hour, at the end of which time no

A liquid chlorine apparatus should always be installed in duplicate in case of a break-down in the operating unit. It is curious to reflect that municipal authorities are frequently quite willing to take a chance with a dangerous municipal water supply by installing only a single liquid chlorination unit, and trusting to luck.

available chlorine was present. The quantity of organic matter in the sewage, nevertheless, was sufficient to use up many times the amount of chlorine employed, so that the bactericidal action of the chlorine must have been exerted to a considerable extent irrespective of the amount of organic matter present. On the other hand, we found that milk required a very large quantity of chlorine to bring about bacterial destruction. It has generally been accepted that fifteen minutes exposure to chlorine is sufficient to destroy any vegetative organisms present. The amount of chlorine necessary for any given water can only be determined by experiment. In Toronto, where the water reaches some dwellings within ten minutes from the time the chlorine has been added, there has been no typhoid or other trouble which could be attributed to the water supply in the course of the last eight years.

Amount Controlled by Color Reaction

The amount of chlorine necessary to disinfect any water may readily be determined by adding variable amounts of a standardized chlorine solution to a known quantity of the water under examination. The amount that leaves a slight excess of available chlorine as judged by the potassium iodide starch reaction, or the ortho-tolidine reaction, in fifteen minutes, is usually considered to be the amount desirable. Turbidity, contrary to the usual belief, does not necessarily demand a larger amount of available chlorine. In fact, sometimes it is just the reverse, the quantity of chlorine required being reduced. In other words, it is probably not the inorganic visible content of the water which uses up the chlorine, but rather dissolved substances, and these may be less or more than usual in a turbid water. The writer found in supervising the chlorination of the water supply of Toronto, amounting to over sixty million gallons a day, that it could best be controlled by the color reaction obtained by treating the water after a given contact period with potassium iodide and starch. It was found many years ago, through experience extending over many months, that with a color index of from three to four of our own arbitrary standard, we invariably obtained practically sterile water as judged by the bacteriological plates. In other words, the bacterial efficiency line ran parallel to the color line, so that when we obtained the required color we knew that we were obtaining bacterial efficiency. This has been thoroughly proved out in Toronto ever since, and my experience during the war, with thousands of waters of all kinds examined on the British front, has absolutely confirmed the experience obtained in Toronto.

All dirty and turbid waters, which practically means all surface waters, should undoubtedly be filtered, even though the tendency among certain people is to view the filter as an auxiliary agent rather than the chief agent to make an unsafe water safe for drinking purposes. The almost universal use of chlorine to disinfect the effluent from a filtration plant is in itself evidence that filters in themselves are not considered to be altogether adequate for the purpose of completely purifying a water supply.

The Chloramine Process

A combination of chlorine and ammonia, constituting the so-called chloramine process, as developed by Race[4] working with the Ottawa River water, in Ottawa, was found there to materially reduce the amount of chlorine required for disinfection purposes. Dr. Hale[5] working on the water of Esopus creek, found that the chloramine process gave no greater efficiency than bleach alone.

Control of Chlorination

We found that it was very desirable to keep the men who operate the liquid chlorine apparatus employed, and a system of periodically testing the treated water for available chlorine has been worked out, to that the men are kept busy making and recording their tests. In consequence, these operators are keenly interested in the work they are doing because they know exactly the why and wherefore of the process, and what failure would mean. Normally they themselves make any necessary changes in the quantity of chlorin ebeing applied, but if anything unusual takes place or the water seems to be changing its character more rapidly than usual, they are instructed to call up the chemist in the laboratory directly responsible for the safety of the water supply. Incidentally there is always a tank filled with hypochlorite of lime solution ready to be employed at a moment's notice, should the liquid chlorine apparatus for any reason fail. Of course in the treatment of a municipal water supply, there must be no break in the continuity of the disinfection. Nevertheless, there are cases on record of engineers responsible for the chlorination of a municipal supply allowing their apparatus to cease operating for days at a time and have even been known to disconnect it and send away parts for repair without notifying the M. O. H. Such conduct is most reprehensible, No engineer or other individual has any right to take into his hands the health of the community, and should be held responsible for negligence in case of an epidemic occurring through his carelessness. The only way that the public can be protected from such casual methods is to install a duplicate system and hold some one individual responsible for the operation of the plant during every minute that the pumps are being operated.

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Objectionable Tastes Developing in Chlorinated Waters

A serious objection to chlorination is due to the fact that tastes are apt to develop in the treated water. Chlorine, itself, in distilled water, has only a slight chemical taste which is not at all objectionable. The offensive tastes that occasionally develop in chlorinated municipal water supplies are derived possibly from combinations with dissolved products from certain algae and protozoa, with residues from gas works and with other unknown compounds.

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[4] Chlorination and Chloramine. Jos. Race, Journal American Waterworks Association, Vol. 5, March, 1918.

[5] The Chloramine Process as Applied to the Catskill (Esopus) Water. Dr. Frank Hale, Journal American Waterworks Association, Vol. 6, November, 1919.

A notable example of an extremely offensive taste occurred in Toronto a few years ago. On this occasion hundreds of complaints poured into the Department of Health to the effect that carbolic acid had undoubtedly been dumped into the water supply. Editorials appeared in the papers and a tremendous hubbub was raised about the matter. Practically everybody, without further investigation, blamed it on careless operation of the chlorination plant. A careful investigation revealed the fact that new boxes painted with soft tar had been placed in the slow sand filtration beds for the reception of the dirty sand scraped from the surface of the sand beds. No taste could be detected in water in which wood, treated with this tar, was allowed to stand for hours. Neither could any taste be detected in lake water which had been treated with the amount of chlorine employed at the time. But when a similar quantity of chlorine was added to water which had been exposed to the tar, a most offensive taste, similar to that complained of, immediately developed, showing that it was a combination of material dissolved from the tar and chlorine. The taste in the water supply had undoubtedly been due to material dissolved from the tarred boxes in the slow sand filters, and it gradually died away as the soluble material was exhausted.

> **Chlorine, other than in minute quantities, must not be added to water passing on to slow sand filtration beds, as a great excess would soon destroy the biological function, and therefore the efficiency of these beds.**

In connection with the matter of taste, a very curious fact has been recently disclosed by Sir A. C. Houston, who has charge of the water supply of London, England. Houston finds that, in treating the Thames River water used in London with chlorine, a taste will sometimes develop, but that an addition of a further quantity of chlorine causes the taste to disappear. This experiment is rather suggestive, but, in absence of more data, is not recommended as a universal practice to get rid of tastes in water.

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Taste can sometimes be removed by the addition of hyposulphite of soda or permanganate, or, in small installations, by passing the treated water through charcoal.

The Effects of Chlorinating Water Supplies on Sewage Disposal

The use of chlorine for treating water supplies has indirectly resulted in a greater disinclination to go in for sewage disposal. Where formerly municipalities knew that it was necessary to both filter their water supply and protect it from unnecessary pollution by treating their sewage either partially or completely, a cheap method of safeguarding the water supply has given them an idea that more expensive protection was not essential. A filter normally removed from 85 per cent. to 95 per cent. of the bacteria present in the water. Where the water was heavily polluted, filters could not be overloaded if the number of bacteria present in the effluent was to be kept to the minimum. This necessitated very careful management, and municipalities polluting their own water supply, or having their water supply polluted by other municipalities, were much inclined to consider such pollution a very serious matter.

At the present time, the old feeling of apprehension has died away to a considerable extent, and the tendency has been to ease up on the demands that sewage be more completely treated. This is most unfortunate, because, with a badly polluted water and careless management of filters and disinfection apparatus, a municipality is always hovering on the border of an epidemic; and it needs only a break in the protective system to bring about a catastrophe.

Pollution of Water Supplies

In general, municipalities situated on rivers are not responsible for the pollution of their own water supply, but are usually responsible for polluting the water supply of some other municipality lower down the stream. On lakes or large bodies of water the pollution of the water supply is usually due to the municipality itself. On the Great Lakes, each city is practically responsible for the fouling of its own drinking water.

> **The use of chlorine for treating water supplies has indirectly resulted in a greater disinclination to go in for sewage disposal. Where formerly municipalities knew that it was necessary to both filter their water supply and protect it from unnecessary pollution by treating their sewage either partially or completely, a cheap method of safeguarding the water supply has given them an idea that more expensive protection was not essential.**

As an illustration: Toronto takes its supply from intakes some eighteen hundred feet from the Island shore. About four and a half miles along the shore is the sewage disposal plant. Through this plant about sixty million gallons of sewage pass daily, after being subject to sedimentation which removes, roughly, 50 per cent. of the settleable solids; the rest is discharged through a pipe running eighteen hundred feet into the lake. Conclusive evidence obtained during a summer's careful investigation by us some years ago in following up currents in the lakes showed that the pollution of the city's water supply came solely from Toronto sewage works or through overflows along the water front and was carried to the vicinity of the intake. Certain winds invariably produce heavy pollution of the city water supply, while other winds tend to bring in clean water from the depths of the lake.

In a paper[6] embodying the results of this investigation, it was stated that the pollution of the water supply of Toronto was due solely to Toronto sewage transported by wind-driven currents, and that no intake could be located within ten miles of Toronto which would not be subjected to dangerous pollution as long as the city sewage was being discharged untreated, or only partially treated, into the lake. From analogy, it was concluded that such wind currents exist in all the Great Lakes, and that the general influences at work near any large city would bring about analogous conditions to those in Toronto. The work of the International Joint Commission on the pollution of international waterways has since amply confirmed the truth of these statements.

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[6] Wind Driven Currents in the Great Lakes and their Effect on Municipal Water Supplies. By G. G. Nasmith, Ph.D., and Fred Adams, M.B., D.P.H., 1914.

The water supply in Toronto at present is all being filtered, either through slow sand or mechanical filters, and is subsequently treated with chlorine. The load on these filters, due to the steadily increasing sewage pollution of the lake water, has become very high, and in view of the fact that the city is growing rapidly, the time is approaching, according to a recent official statement, when raw water may have to be passed into the city's water supply system; in such case chlorine will be the only safeguard. In view of this combination of circumstances, and the fact that the water is becoming more heavily polluted each year, the situation is not a desirable one to contemplate. Though self-purification is undoubtedly going on to a wonderful degree in these large bodies of water, it is interesting to note that pollution was found in Lake Ontario, by Dr. Amyot, at a depth of over six hundred feet, and by ourselves, in some cases, at a depth of one hundred feet, and was traced on the surface for ten miles in all directions from the city.

There is no doubt that, taking everything into consideration, chlorine has been a Godsend to the world, and has undoubtedly reduced the mortality from typhoid fever to the irreducible minimum in many municipalities formerly scourged by this disease. In America alone there are probably a thousand chlorine installations for the disinfection of municipal water supplies.

At the present time, the old feeling of apprehension has died away to a considerable extent, and the tendency has been to ease up on the demands that sewage be more completely treated. This is most unfortunate, because, with a badly polluted water and careless management of filters and disinfection apparatus, a municipality is always hovering on the border of an epidemic; and it needs only a break in the protective system to bring about a catastrophe.

Nobody, however, wants to drink dirty chlorinated water containing mud, sand, weeds, fish, worms and other dead and living matter such as is commonly found in all surface water supplies. In all such cases I believe that water should be filtered as a preliminary to disinfection.

General experience has proved that, with proper control, chlorine, in any of its available forms, has been an exceedingly valuable agent in helping to eliminate enteric disease. The installation is cheap, the treatment is effective, and as long as properly supervised, and breaks in its continuity prevented, it can be depended on. Even though there are difficulties in application and in the development of tastes, and though it is dependant on the human element, it is nevertheless an exceedingly efficient and reliable process, and one of the greatest discoveries that sanitarians have made during the last century.

Nova Scotia Stone Co.'s Plant at Lake Williams, N.S., is Model of Efficiency

PERHAPS the largest and most expensive stone breaking layout of a permanent nature in the Maritime provinces is the plant of the Nova Scotia Stone Co., Ltd., at Lake William, N. S., on the Dartmouth Branch Railway, between Dartmouth and Windsor Junction. There is, in this plant, every facility of a modern character for crushing and sorting stone for concrete road building, etc. The stone is obtained from a cliff of clear whin or quartzite, containing approximately 2,000,000 tons immediately available. The face of the cliff is about 60 ft. high and over 50 per cent. of the raw material is on the high levels and is available for handling by gravity. Engineers who have examined the quality of the stone state that it is of a very superior quality without any traces of slate or iron, the presence of which would be very detrimental to good concrete.

The plant is well equipped with modern machinery, making it possible to convey stone from the cliffs to the crushers by gravity. From the primary crushers the stone is elevated to the first screens which take out all of the marketable sizes, the oversized being conveyed on belt conveyors and re-crushing machinery, the products of which are further sorted. The final product is deposited in bins which are at such an elevation that railway cars are loaded entirely by gravity.

The siding accomodation is arranged for 12 of the largest railway cars at a time. The power house is equipped with modern boilers, engines, air compressors, etc.

On the whole, the plant is well balanced and arranged for the maximum of economy in operation. The property is well located for shipment to the various markets and the Nova Scotia Stone Company have distributed their product as far as Moncton and Sackville in New Brunswick and Charlottetown in Prince Edward Island. On account of their excellent facilities for prompt and quick deliveries they are prepared to handle large quantities of broken stone for any special job. Up to the present, the company have been unable to keep up with the demand, but they are now installing additional equipment, which, when completed, will place them in a position to take care of any ordinary demand which may develop for a long time to come.

Stone from this plant has been used in the construction of the Imperial Oil Company's large plant at Imperoyal, Dartmouth; the Arcadia Sugar Refineries Company, Dartmouth; the Halifax Shipyards, Halifax; and the Robert Simpson Company's building, Halifax.

Operations have commenced on an addition to the factory of the Parisian Corset Manufacturing Co., Ltd., Quebec. The total estimated cost is $110,000. The work is scheduled for completion by December 1st next. The architects are Messrs. Staveley & Staveley, Quebec, and the contractor for the masonry is Mr. A. Fackney, and for the carpentry, C. A. Vezina, both of Quebec. The remaining contracts have not yet been awarded.

Alkali Soils of Prairie Provinces Cause Decay of Concrete Structures

Millions of Dollars Worth of Foundations, Sewers, Pipe Lines, Irrigation Works, Retaining Walls, Abutments, Etc. Are Subject to Destruction—No Cure Seems Yet Available But Investigation is Being Carried Out—Measures Being Taken to Save Winnipeg Aqueduct

By W. G. Chace, M.E.I.C., Chief Engineer, Greater Winnipeg Water District

MUNICIPALITIES, corporations and private owners in the prairie provinces of Canada and in the central states of the United States are facing the tragedy of the loss by decay of the structures of concrete, in which they have invested large sums of money, for sewers, water supply lines, irrigation syphons and head works, retaining walls, bridge abutments and deep foundations of buildings. Millions of dollars invested will be lost or have already been lost, and works covered by long-term bond issues must be entirely rebuilt in many cases before the expiry of even one-third of the term of the bonds. Rebuilding or repair of injured structures should be done with a full comprehension of the risks involved and with every precaution possible to prevent repetition of the disasters experienced. The efforts of the engineers and chemists who have been giving their attention to this subject during the past few years should be strongly supported financially and with co-operation by all interested corporations.

Widespread Decay of Concrete Structures

Injury to concrete structures underground in the vicinity of Winnipeg was noted as early as 1912, but defects therein observed were laid to poor concrete either by reason of improper mixture or inefficient workmanship. The examples noted had been comparatively rare up to that time, and even until 1917, probably because of the comparatively short period during which the concrete works had been exposed to injury underground. Of later years observed injuries have been more and more frequent and have included foundations of important buildings in Winnipeg, large and small sewers in St. Boniface, twenty-four out of forty-five miles of concrete sewers in the city of Winnipeg only recently reported to be in serious condition, and most lately a portion of the new aqueduct of the Greater Winnipeg Water District. In Saskatoon, injury to building foundations and floors has been noted. In Moose Jaw, besides injury to building foundations, subway walls have suffered. In Alberta, concrete syphons, head works of irrigation canals, drops and other structures in irrigation work besides concrete structures and mine props in coal mines have all suffered and to a serious degree. Similar experiences have been reported from various sections of irrigated territory in the United States.

The subject has been under study by different bodies for some years. The Agricultural College of Montana issued Bulletin No. 81 and Circular No. 8; the Experiment Station of the Agricultural College of Colorado issued Bulletin No. 83; the Bureau of Standards, Washington, D.C., working with the Reclamation Service issued Technological Paper No. 92, the most complete study yet published. It was early discovered that the injury generally arose from the presence of "epsom salts" and "glauber salts" in the soil waters; from these salts the sulphate molecule combined with calcium of the concrete to form gypsum; this action takes place more rapidly in the presence of common salt. The rate of decay is now recognized by most students to be dependent upon the concentration of the salts in the ground waters. It is also recognized that all practicable mixtures of portland cement concrete will decay if set in a soil whose ground waters are saturated.

Several Theories Prove Fallacious

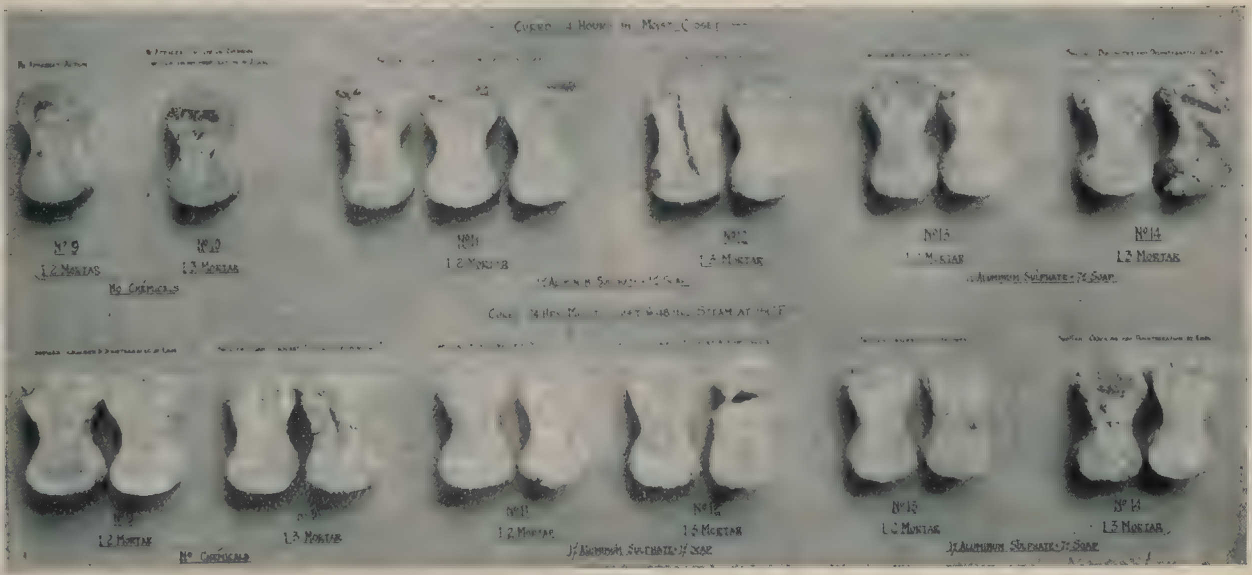
During 1917 and 1918 the laboratories of the city of Winnipeg and of the Greater Winnipeg Water District spent some considerable time in trying out two or three theorems. The theorem that concrete which had been premoulded and cured before placing in the ground would be immune was explained, first, by artificial steam curing of mortar briquettes which, when exposed to concentrated solutions of magnesium and sodium sulphates, suffered decay; second, by the observation of the effect of soil waters upon premolded sewer pipe of concrete anl upon manhole rings of premolded concrete.

The theorem suggested by Montana College bulletin that an integral treatment with soft soap and alum would be effective by preventing access of soil waters, was also exploded by laboratory tests covering a period of three to six months on briquettes of various densities so treated and then exposed to concentrated sulphate solutions.

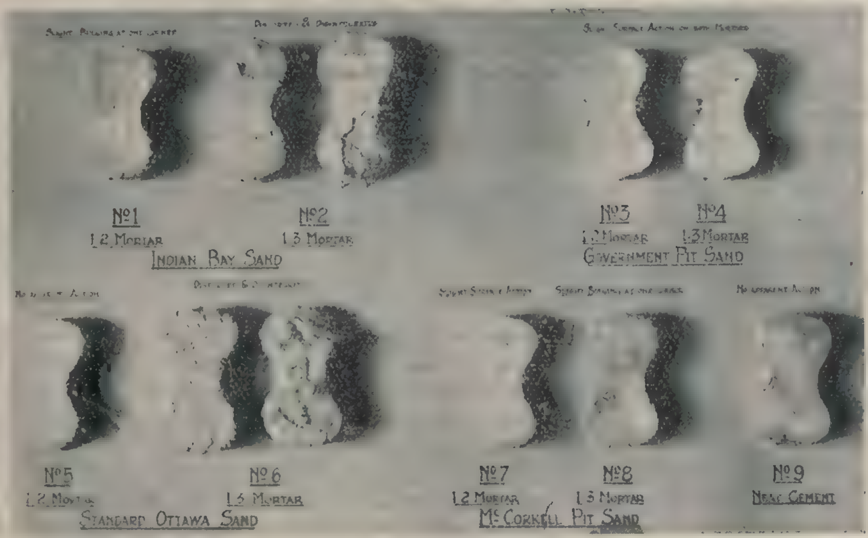
It had been observed that concrete composed of limestone sands and aggregates seemed to be transformed entirely by the sulphates leaving in the mass the pebbles alone without transformation; the grit of the sand originally present had disappeared so that the mortar magma had become but a putty-like mass of gypsum. This suggested that a concrete comprising chiefly silicious aggregates might be immune but laboratory experiments soon proved that the destruction of the mortar was not thereby prevented; and that in some manner the constituents of the portland cement offered the key to the risk to which concrete is exposed.

E. I. C. Taking Matter Up

In 1917 the Engineering Institute of Canada, Manitoba Branch, appointed a committee to study this subject. In August, 1918, the matter was brought formally to the attention of the Institute in brief papers by Messrs. B. Stuart McKenzie of Winnipeg and A. S. Dawson of Calgary, before the professional meeting of the Institute at Saskatoon. As a result of this meeting the Institute, as a national body, appointed a committee of twelve men, four from each of the three prairie provinces, to report on the subject from time to time. This committee has finally succeeded in obtaining the support of the Portland Cement Association of America, and is negotiating for further support from the Research Council of Canada. The committee feels that the onus of the question lies, primarily, with the Portland Cement Association, as the manufacturers of cement are on the defensive in the matter. The subject, however, is of so great importance to a large proportion of Canada that the activity of the Research Council should be engaged and cost and difficulty of what is really a tedious and expensive study should not be loaded upon the professional men.



Above: Samples of briquettes showing action of sulphate solutions on mortars treated with soap and aluminum sulphate. Briquettes immersed in solution for eight months. Solution used is 10 per cent. magnesium sulphate.



Left: Shows action of a 10 per cent. solution of magnesium sulphate on various mortars. All briquettes cured 24 hours in moist closet and 48 hours in steam at 150 degrees F. and kept in alkali solution 3½ mos.

The studies of the Bureau of Standards suggest that soil waters bearing more than 0.1 per cent. of salts are dangerous to concrete. In some areas, especially in the neighborhood of Winnipeg, it has been noted that the degree of concentration in the soil waters varies in the most extraordinary manner, for instance, a recent report on soil waters from consecutive stations along the 96 in. pressure pipe element of the District's aqueduct vary as follows in parts per million of total solids:

Station 861 + 00	1299	Station 864 + 00	4439
Station 862 + 00	6354	Station 865 + 00	1275
Station 863 + 00	4554		

In parts of SO^4 per million the following consecutive proportions have been noted:

Station 856 + 00	474	Station 862 + 00	4459
Station 857 + 00	647	Station 863 + 00	3018
Station 858 + 00	2697	Station 864 + 00	3043
Station 859 + 00	5585	Station 865 + 00	621
Station 860 + 00	2304	Station 866 + 00	185
Station 861 + 00	3505		

The soil here is a very dense, impalable clay and it is manifest that the soil waters move but very slowly indeed. The injury to the concrete structure is noted to be proportional to the concentration of salts observed. Further, while the problem is for this area local in detail, it is so general as to affect entire structures and to require a general treatment for such structures.

Underdrainage to be Tried on Aqueduct

To save the pressure conduit of the Water District a plan for uncovering and backfilling of the lower portions of the trench with screened gravel in which an outletted vitrified tile will be laid has been recomended in the expectation that, if the structure can be kept dry and the ground waters removed without coming into contact with the conduit the injury must cease and the structure remain sound. Twelve miles of pressure conduit crossing the Red River Valley was so built in underdrained trenches and it is unfortunate that the same system of underdrainage had not been extended eastward throughout the entire district of alkali clays of the Red River Valley. As indicated by a study of this article the technical information available on the subject of the decay of concrete is not even yet completed and at the time of building the Water District's aqueduct the best information available was to the effect that a dense impervious concrete would be proof against injury by alkali soil waters, an opinion unforunately not well founded.

Sewers and deep foundations of buildings cannot be underdrained; caissons of concrete supporting heavy buildings in this "alkali" territory must decay. For sewer structures of large dimension there must be discovered a new specification if concrete is to be used safely.

The photographs shown herewith are: First, a series of briquettes which had been treated with soap and sulphate of aluminum and had been kept in a solution of magnesium sulphate for eight months. These photographs should be convincing to the reader. If those interested in sound principles of construction and those interested in the welfare of western communities will lend their sympathy and support to the men who are struggling with this most serious problem, there is hope that the emergency may be met and the engineering profession relieved of a cloud which otherwise it must unjustly bear.

Progress in Purification of Toronto Water Supply During the Past Fifty Years

By Norman J. Howard, Bacteriologist-in-charge, Filtration Plant Laboratories, Toronto

That Toronto's water supply is one of the best on the American continent is indicated by the fact that the typhoid death rate is the second lowest. The attainment of this condition forms a long and interesting story, for Toronto has grown rapidly and its water was not always as pure as it is to-day. An account, therefore, of the development of the water supply of Toronto from 1870, when its population was 50,000, until 1920, when its citizens number over half a million, records a remarkable achievement. In this article Mr. Norman J. Howard, bacteriologist in charge of the city's filtration plant, turns historian and gives our readers an illuminating insight into the difficulties that have been met and passed by those who have been responsible for providing for Toronto an unusually good water supply

THE attainment of the present high degree of purity of the Toronto water supply has involved many difficulties during the past fifty years, and the history of the progress and numerous problems encountered and overcome presents the most remarkable achievement of any city in Canada.

In 1870 the population just exceeded 50,000, while in 1920 it has risen to the half million mark. The report as recommended and adopted in 1872 was presented the first phase of water purification, the plant whch was built consisted of an open filtering basin at the Island and through the shallow water of Blockhouse Bay. The water was then passed over to the city through a 36-inch iron pipe laid across the harbor to John Street. Provision was made for the water filtering naturally through the sand basin, the consumption at this time being three and a half million gallons daily. In 1875 the filtering basin was placed in commission, it having been tested out and found that with a five-foot head nearly four and a quarter million gallons could be obtained in twenty-four hours. Whilst the tests were being completed, the wooden conduit which was in use rose to the surface. This pipe was of wooden staves, four feet in diameter and about 6,000 feet in length, the depth being about 12 feet below low water. The low water in 1874-75, and the failure of the contractor to sufficiently cover the pipe, were doubtless the cause of its rising. Repairs were completed and water supplied from Blockhouse Bay in 1876. A 36-inch cast iron pipe with flexible joints connected the northerly end of of the four-foot wooden conduit with the pumping station, the distance across the bay being 4,444 feet.

In the spring of 1877 it was decided to dredge two open cuts or channels from the basin to the lake. One of the cuts was filled with stones, and in the second a wooden conduit was laid into the lake for a distance of 245 feet, terminating in a crib 20 feet square and about 7 feet in height. Under a head of 22 inches the capacity of the stone filled cut was determined to be 10 million gallons per day. From 1878 until 1882 the water supply was frequently interrupted, both the intake pipes becoming blocked with sand and foreign matter.

Quality Was Poor

Actually the quality of the water was so bad in 1879 that the citizens were under the impression that the supply was being drawn from the bay. As a result of the unsatisfactory conditions a commission was appointed, and they reported the water in the filtering basin when pumped down as "being exceedingly filthy" and recommended that a tunnel be constructed about 2,000 feet in length and water be taken from the lake at a depth of 30 feet. In 1881 the construction of a wooden intake pipe, 6 feet in diameter and 2,628 feet in length, was commenced. The pipe terminated in a submerged rectangular timber crib erected in 30 feet of water and was completed late in 1882. For a few years this source seemed adequate to supply a reasonably pure water to the citizens who in 1884 had increased in number to 105,000 consuming nine million gallons of water daily.

The capacity of the pipe across the bay was reached in 1887, when the superintendent advised the laying of another pipe. This was deferred pending a report upon gravity supply presented by Messrs. Kivas, Tully and W. J. McAlpine, of New York. The report was presented in February, 1887, and recommended obtaining the supply from the Oak Ridge lakes and the rivers Don and Rouge.

In the early summer of 1888 the consumption of water exceeded the capacity of the pipe across the bay, but no steps appear to have been taken until 1889, when another report was presented by Messrs. Rudolph Herring and Samuel Grey who advised the city to adhere to Lake Ontario as the source of supply. Following this report, tenders were called for a duplicate pipe across the bay, and a conduit across Blockhouse Bay and the Island. From the pumphouse to Hanlan's Point, the pipe was to be 48 inch steel, and a 60-inch steel pipe from there to the south shore of the Island. It was also considered advisable to extend the 72-inch wooden intake pipe 340 feet further into the lake to a depth of 70 feet of water, this extension to be of steel. Construction was hurried and the whole work was completed in 1891.

It now seemed that the water difficulty was settled as the intake was in 70 feet of water and the capacity of the conduits considerably exceeded the demand. However, on Christmas Day, 1892, the new steel pipe across Blockhouse Bay and the Island rose to the surface through the ice, the rising being attributed to the screens at the shore crib becoming blocked with weeds. During the winter months the new conduit was replaced in position, the city supply being taken from Blockhouse Bay in the meantime.

Frequent Interruptions in Supply

The average daily consumption in 1893 exceeded 18 million gallons, the population of the city being 170,000. On September 5th, 1895, the steel conduit rose again in Blockhouse Bay. As a result a small settling basin was constructed on the south shore of Blockhouse Bay, into which a supply of lake water flowed through the intake, and the conduit which was opened at that point. A connection was made at this settling basin with the old four foot wooden conduit which conveyed the lake water from the settling basin to Hanlan's crib. For two days the city was supplied with water from the reservoir. Blockhouse Bay was drawn upon until the middle of October, when connection was made with the settling basin. The second rising of the steel conduit was attributed to an accumulation of sand in the conduit, and the low level of water in the lake.

At this time considerable discontent was manifest at the periodical interruptions in the supply, and the question of obtaining the city water from Ridge Lakes or Lake Simcoe appears to have been seriously considered. The consulting experts Messrs. Herring and Grey reported against both schemes. A private company offered to supply up to 30 million gallons per day at one and one-half cents per thousand gallons, and at one cent per thousand gallons for all that might be required over that quantity. The water was to flow from Lake Simcoe by gravity through pipes, tunnel and conduits, and to be delivered into reservoirs north of the city at an elevation of not more than 400 feet above Lake Ontario. The quality of water was to be of standard purity to meet the requirements of the city or the Provincial Board of Health. Numerous observations were made to determine the quality of Lake Simcoe water, Drs. Ellis and Pyne clearly demonstrating at the time that the quality of the water was distinctly less pure than that of Lake Ontario water.

Lake Simcoe Source Denounced

The outcome of the controversy was the calling-in of Mr. James Mansergh, of London, England. His report, which was quite comprehensive in character, advised the city to adhere to Lake Ontario water as source of supply in preference to Lake Simcoe. He severely denounced the Lake Simcoe proposition, his report in part reading: "The whole proposal bears, on the face of it, evidence that it is not based on any substantial foundation, and I should suppose that no engineer has been consulted about the details of the offer made to the city council. If this offer were accepted, I am quite positive that the bargain would never be completed by the company, and the whole business would end in a miserable fiasco. Moreover, I advise distinctly that the water supply to any city should never be entrusted to a company, however serious and stable. It is essentially a municipal business and whenever a competent, incorruptible and truly representative municipal authority exists, that body should administer and control the water supply in the sole interest of the ratepayers, and without increasing its cost by providing dividends to shareholders."

Mr. Mansergh's report was delivered to the city council in the spring of 1896 and embodied in his recommendations were (a) relaying of the lake intake pipe, (b) pumping station on the Island, (c) filtration plant on the Island (ultimately), (d) new conduits across the Island and tunnel under the bay. He also suggested that steps should be taken to remove the discharge of city sewage into the harbour. Part of the recommendations made were adopted by the city, and the improvements carried out. They included the building of a new steel intake pipe, 2,200 feet out in the lake, the construction of a waterworks system on the Island, a new 72-inch steel conduit across the Island and a tunnel under the harbor.

Tunnel Under The Bay

The construction of the tunnel under the harbor was quite a remarkabe feat of engineering. The tunnel is practically a horseshoe in cross section, eight feet in diameter and eight feet in height, with an internal area of 54.7 square feet. At the city end the vertical shaft has a depth of about 77 feet beneath the zero of the lake and at the Island end, a depth of 93½ feet.

While extensive improvements were being made to secure a pure water, the volume of sewage discharging into the bay was increasing, and was considered so serious that City Engineer Rust was sent to England to report on sewage disposal work. Numerous reports were made including: (1) The discharge of crude sewage into the lake; (2) filtration scheme and discharge of effluent into the lake nine miles east of the waterworks intake; (3) septic tanks and filter beds; and (4) sedimentation and removal of solids, effluent to be discharged into lake four and one-half miles east of waterworks intake. The last mentioned recommendation by Messrs. Rudolph Herring, of New York and John D. Watson, of Birmingham, England, was finally adopted in 1909 and construction of the disposal works at Morley Avenue was later commenced. It was not thought at this time that any danger of pollution of the water supply would occur, the prevailing currents being from west to east.

Storms Interfere With Supply

From 1895 to 1910, a period of fifteen years, lake water was supplied to the citizens without interruption. About December 12th, 1910, a severe storm occurred on Lake Ontario and floating fields of ice were driven against the south shore of the Island. On December 13th, an interruption was observed in the flow of water into the wells of the pump house, and an examination showed that the tank at the south shore of the Island connecting the conduit with the intake was empty, but within a few hours it cleared itself and pumping was resumed. On February 6th, 1911, a second storm occurred, followed by a shortage of water. From February 7th to February 16th, the supply was irregular and not equal to the demand. It should be noted, however, that it was necessary to close down the pumps when making examinations with a diver. On February 15th, a cutting was made into Blockhouse Bay from the old settling basin (which was constructed in 1895), from which source the city was supplied until May 10th. Examination of the intake pipe showed two distinct displacements and on account of the severity of the weather great difficulty was experienced not only in repairing the pipe, but in connecting up a temporary intake. The latter was finally placed in position at the end of June, from which date until August 18th, the greater part of the city supply was drawn. The intake was 750 feet from the shore crib, in about ten feet of water. Final repairs to the intake were completed in the fall of 1911.

Sewage Polluted Water

Prior to the break in the intake, Mr. Allen Hazen of New York, had been advising the city on a water purification plant and recommended the construction of a slow-sand system. The population had now grown to 360,000 with a daily consumption of 34 million gallons. It was decided to build the filtration plant at the Island and work was commenced late in 1910. In 1911 a board of water commissioners was appointed to consider and report on the whole water situation including the existing and future needs. The commission consisted of Mr. J. G. Sing as chairman and Messrs. Isham Randolph, T. Aird Murray and Willis Chipman. Numerous reports were issued during the period between the break and the repairing of the intake pipe, most of which were acted upon. The commissioners went on record as opposed to the discharge of sewage into the lake due east of the waterworks intake, unless adequate provision was made to render the effluent innocuous by sterilization or otherwise guarding against infectious matter being discharged into the lake. Experience has shown that their contentions were justified and that the sewage disposal works has actually seriously polluted the raw water.

The third interim report recommended extensions and improvements to the existing waterworks system, consisting of duplication of the Island pumping plant and of the filtration plant. This report further outlined an additional water supply from Lake Ontario, at a point in the vicinity of Scarboro, utilizing the high elevation of land in that locality for the purpose of a reservoir. Lake Simcoe as a source of supply was again touched upon but reported against, on account of impurities contained in that supply.

Works at Scarboro Proposed

The commissioners' final report described the proposed new works at Scarboro, and included an intake two miles from shore in 100 feet of water, seven miles east of the effluent discharged from the Morley Avenue disposal works. Frequent observations on the physical quality of the water were made at the filtration plant laboratories, and showed the raw water to be free of turbidity even after severe storms. Comparison with water at the existing intake showed the quality of water at the proposed intake to be much superior, as while one intake frequently gave a high turbidity, the other was free from such. A mechanical filtration plant was to be constructed on top of the reservoir. An elaborate chlorinating system for emergency service in connection with the filtration plant was to be provided and so located that chlorine could be applied to the raw or filtered water, although it was recommended that the water should be filtered at all times. The capacity of the reservoir was to be 130 million gallons and it was to be subdivided into four units so that any single unit could be emptied and inspected if occasion arose. From the reservoir the water was to flow by gravity through a steel conduit to the city. It was estimated that the construction of the proposed Scarboro works would take from three to five years to complete and would cost five and a half million dollars. With the presentation to the city of the final report embodying the above mentioned recommendations, the work of the commissioners was concluded.

Growth of City Demands Extension to Filtration Plant

In January 1912 the slow-sand plant was completed and put in commission. From the outset considerable controversy arose as to the wisdom of the city in adopting this system of filtration. Before the plant had been in commission six months, the consumption of water in the city had outgrown its capacity and a mixture of filtered and unfiltered water had to be supplied the consumers. About this time Mr. R. C. Harris became Commissioner of Works and immediately investigated the conditions and recommended the duplication of the filtration plant. It was largely due to his speedy efforts that the new filtration plant was built and the citizens supplied with filtered water entirely. The old controversy as to the most suitable system of extension delayed the building of the plant for over a year and it was not until the early summer of 1914 that the contract was awarded for the construction of the present drifting-sand plant. The reasons given for the change in system were difficulties in operation, caused by a combination of occasional high turbidity and the low temperature in the winter months. As regards purification, the slow-sand plant proved wonderfully effective, and gave bacteriological results showing a removal of over 99 per cent. The drifting-sand plant was completed and taken over by the city in the summer of 1918. The combined working capacity of the two plants is approximately 80 million gallons, and as this is at times barely sufficient to meet the summer demands, a further extension has to take place in the near future.

Relation of Purification to Public Health

The remarkable results obtained in recent years by purification of the city water supply, are only too apparent. Loss of time, energy and money spent in combating typhoid fever make one wonder why the beneficial effects of filtration and sterilization were not more fully appreciated and secured at an earlier date. The following table shows the population since 1870, the consumption per capita, and typhoid mortality per 100,000 of population:—

	Population	Consumption per capita	Typhoid mortality per 100,000
1870	55,000		*
1880	80,000	64	*
1890	167,000	86	93.1
1900	199,000	110	21.0
1910	340,000	101	44.1
1915	475,000	107	1.9
1919	495,000	128	2.6

*No record

If it is considered that in 1910 one hundred and fifty lives were lost through typhoid and this figure had been reduced to 13 in 1919, the wonderful prophylactic work of the Works and Health Departments is apparent. It is certainly cheaper to treat the water efficiently than to bear the burden of disease and death. The raw water as supplied to the city for purification purposes is still seriously polluted, and only by maintaining a highly efficient purification plant and final sterilization, together with adequate provision for a future supply, can the city be sure that the danger from a typhoid epidemic has been removed.

Pure Water Reduces Prevalence of Many Diseases

Of recent years American sanitarians have not only associated typhoid fever with impure water supplies, but have regarded the latter as also being a contributory factor in numerous other diseases not usually associated with water supply. The following extract (being a quotation from a paper by Hyde on "The sterilization of water supplies by the use of hypochlorites") is of particular interest. It is extracted from the excellent monograph of Sir A. C. Houston, probably one of the greatest living authorities on water supply. It is not given as his own views but as those of certain American sanitarians.

"Messrs. Mills (1893), Reincke (1893), Hazen (1904), Sedgwick (1910), and others have shown that when a pure water supply has replaced an impure one in a community, the general death rate therein is generally reduced in a considerably greater degree than would be accounted for by the reduced prevalence of typhoid fever and other recognized typical water-borne diseases. A study of the vital statistics of numerous places where the quality of the public water supply has suddenly been changed from bad to excellent, as for instance, by the construction and proper operation of adequate purification works, has shown that for every person thus saved from death from typhoid fever, approximately three other persons are saved from death from other causes, many of which have probably never been thought to have any direct connection with, or to be especially affected or influenced by, the quality of the public water supply."

"This numerical statement of the reduction in death rate more or less directly due to improved water supplies has recently become known as the Hazen Theorem, because Mr. Allen Hazen in 1903-05 was the first to announce in definite terms this interesting and most encouraging phenomenon. Even such unexpected diseases as tuberculosis, pneumonia, bronchitis, and a series of disturbances causing undue mortality among infants seem to be decidedly affected by the changes in the quality of the water supply. From general principles it is to be inferred that the drinking of a polluted and unsanitary water supply must surely tend to lower the vital resistence. On the other hand an improved water supply must mean a real improvement in the general health tone of the community, a real uplift and reinforcement, rather than an impairment of the vital resistence of the consumer of such supplies."

Monetary Value of Typhoid Losses

Professor Whipple has estimated that each typhoid death costs the community $10,000. This figure has been generally accepted by sanitarians all the world over, and if it is applied to Toronto, it will be seen that in 1910 the typhoid epidemic cost the citizens one and a half million dollars. This is based upon the assumption that each typhoid death represents usually about ten cases of the disease. In 1919 when only thirteen deaths occurred, the amount was reduced to one hundred and thirty thousand dollars.

Reverting back to the conditions that existed in Toronto, the city engineer's report of 1893 contained the following: "The entire water supply of the city at the time the works were placed under my charge, was being drawn directly from sewage-polluted waters, and as a natural consequence, typhoid fever cases and deaths increased to such an alarming extent as not only to cause the greatest anxiety, but to threaten the business prospects of the city." Conditions were better in the succeeding years following an improvement in the water supply, but typhoid became epidemic in 1910 and early in the spring, the raw water was chlorinated for the first time. It was not until May of that year, that an efficient system was adopted. Following the effective chlorination of the water, typhoid decreased rapidly and in 1911 the rate had been reduced to 21.6 per 100,000 of population. In 1912, filtration and chlorination were employed and the rate fell to half and has fallen steadily ever since. At the present time Toronto is fortunate in having the second lowest typhoid death rate in America, and having a water which when delivered to the consumers is clear, cold, bright and practically sterile.

Co-operation Has Maintained Excellent Results

For several years past close co-operation between the Works and Health Departments has done much to keep the purification plants up to a high degree of efficiency. The city water is sampled day and night, over forty examinations being made daily in the filtration plant laboratories at the Island, which are possibly the best equipped and most efficient water laboratories in the Dominion. Experimental and research work is also carried out in these laboratories, and efforts made to assist in maintaining a highly purified water at a minimum cost. In the city the chlorination plant is accurately controlled by the laboratories of the Department of Health. An elaborate Wallace and Tiernan outfit is in commission and the water is

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Traffic Census as Basis for Road Design

Roads Should be Built for the Traffic They Are to Carry—Analysis of Traffic Data Enables Relative Importance of Roads to be Determined, Type of Construction to be Fixed or Traffic to be Regulated—Haphazard Methods Eliminated by Collection of Definite Figures

By W. A. McLean, Deputy Minister of Highways, Ontario

ROADS should be built for the traffic they are to carry. This is an axiom of road building which cannot be too strongly emphasized, but which by many road authorities has been met in a hazy experimental manner, and without proper consideration of probable traffic; and the quality of wearing surface, its width, and the strength of foundation have not been been adapted to anticipated traffic. As a result, we find single track gravel roads where double track roads or a concrete pavement should have been built; and conversely, asphaltic pavements are rolling and disrupting in idleness where a good gravel roadway would better have served every purpose. It follows, then, that adequate information as to traffic is desirable as a rational basis for designing the road or pavement which is to serve any given location, and as a basis of determining whether an expenditure of $1,000, $10,000 or $50,000 for any given work would be justifiable.

Meaning of Traffic Census

What is a traffic census? On the parallel of a census of population it might mean a complete summation of traffic passing over all the highways of a county withn a lengthy period, including the number of vehicles, passengers and amount of freight. Such data would no doubt be very useful, but so far as the writer is aware, a census of traffic on such a scale has not been attempted. The term usually signifies an enumeration of the number and kind of vehicles passing a given point on a highway in a limited period of time—a day or a week or a fortnight, and generally omits as unimportant, the night travel. The census may be limited to one highway, or may include a series of highways, and may be at regular or irregular intervals.

Limitations of Value

The value of a traffic census has limitations which are at once evident. Thus, the amount of traffic which will pass over many roads after construction may bear little relation to the traffic over the unimproved road. In such cases, it is the potential traffic of a district which should be considered, rather than existing traffic; but definite data, obtained from actual count, is of use in determining the probable traffic which the improved road will be called upon to carry. Thus on the Toronto-Hamilton highway, traffic amounted to from 300 to 700 vehicles at various points; but with the completion of the concrete pavement, these figures leaped to 2,500, between the hours of 7 a.m. and 7 p.m.

The potential traffic of a district preceding the construction of a road is a matter for careful estimate, just as probable traffic for an electric or steam railway may be based on the population and industries served. A somewhat interesting series of charts was published in the report of the Ontario Highway Department for 1915, a net result of which was to show that not less than 80 per cent. of the traffic of the Province is carried by 20 per cent. of the highways; that 80 per cent. of the roads are but lightly travelled, and are such as can be adequately built with a single track of gravel or broken stone, also that few roads serving a purely rural population would be required to carry a maximum of traffic much in excess of an average of 200 vehicles a day. Traffic in excess of that amount, except adjacent to the largest cities, may usually be attributed to inter-urban influences.

Application to Construction

Knowing the potential traffic of a district, the highway engineer turns to data of the carrying capacity of various types of road and pavement—a matter in which there is room for much diversity of result. For example, limestone gravel has less wearing capacity than a gravel from trap or granite. The foundation and subsoil have a decided bearing on the case. Roughly, and with scope for much modification, the wearing capacity of various materials as used in Ontario, may be broadly gauged from the following schedule:

	Single horse	Two horse	Light trucks or passenger cars	Motor truck	Total
Single track gravel	40	15	20		75
Double track gravel	50	50	100	5	205
Water-bound macadam .. (single track)	50	30	40		120
Water-bound macadam .. (double track)	90	50	100	10	250
Double track gravel .... oiled or tarred	175	75	400	10	660
Double track macadam .. oiled or tarred	200	150	600	50	1000
Macadam penetration bituminous	200	300	1000	50	1550
Macadam foundation bituminous concrete ...	200	400	2300	100	3000
Bituminous concrete on cement concrete foundation	200	400	4200	200	5000
Cement concrete	200	200	4400	200	5000

Some Purposes of Census

Among the purposes which a traffic census may serve are the following:

(1) To determine the traffic importance of one road as compared with another in the same system, and thus to differentiate between different roads as to community value. This data may be useful in laying out a system, especially with a view to granting government subsidies.

(2) To determine the traffic value of the same road before and after improvement. Such information is useful in determining the economic value of highway improvement.

(3) To determine the increase of traffic on the same road during a period of say 5 years, by two

different censuses. Such data is useful in anticipating future increases in highway travel.

(4) To determine character of traffic, whether farm, local between centres of population, or tourist, and thus to arrive at a fair distribution of cost.

(5) To determine respective percentages of horse-drawn, passenger car, and motor traffic, and by comparing previous censuses to estimate future changes with a view to adjusting type of construction.

(6) To determine total gross tonnage passing over a fixed point for a period of 12 daylight hours, in conjunction with the speed at which this tonnage travels—useful data in determining:

(a) Amount of wear, including impact and displacement resistance sustained by a certain type of roadway, comparing this with maintenance charge per year;

(b) Whether such roadway is economically fitted to bear this gross tonnage.

(7) To determine the importance of various phases of traffic and therein determine the loadings and speeds which should be permitted—for purposes of traffic regulation.

Traffic Census in Ontario

The first census in Ontario was taken between October 15 and November 15, 1913, at 20 stations on representative county roads, a large number being now part of the provincial highway system. The count was taken for seven consecutive days from 7 a.m. to 7 p.m., and classification of vehicles was divided into: 1 horse light; 1 horse heavy; 2 horse light; 2 horse heavy; motor runabouts; touring cars; and motor trucks.

Enumerators were provided with a card for each day with columns for each 2-hour period; for each of the above classes of vehicle a space was provided. The method of recording was by making one tick for each vehicle. These ticks were added and checked by the inside staff of the department. The conditions of roads and weather were specified. Owing to the choice of a period when traffic was particularly light, a minimum traffic census was thus obtained.

A second census was taken at the end of July and the beginning of August, 1914, at 210 stations on roads radiating from 21 cities, for seven consecutive days from 7 a.m. to 7 p.m. The classification of vehicles was the same as in the first census, the condition of road and weather being described. Additional information, bearing on local industries and pecularities of traffic, was also secured.

Census for certain localities were taken in 1915, on Dundas Street just west of Islington; in 1917, on the Lake Shore Road just east of Mimico; and in 1918, at several points on the Queenston-Grimsby highway and Dundas Street.

Some American Results

In Massachusetts, a traffic count has been made at three year periods since 1909. The actual count is made for 14 hours a day (7 a.m. to 9 p.m.) for 7 consecutive days in August, and 7 in October. The count is also made at night at a few important points so as to cover the whole 24 hours. The classification is divided into light and heavy horse-drawn vehicles, automobiles and light trucks, and heavy trucks. The following is a table of assumed weights:

Runabouts	1.45 tons
Touring cars	2.23 tons
Trucks	6.25 tons
1 horse, light	0.36 tons
1 horse, heavy	1.12 tons
2 or more horse, light	0.54 tons
2 or more horse, heavy	2.46 tons

The result of the census shows the percentage of each class and the percentage that each class is of the total traffic.

Thus in 9 years the total average daily traffic on roads has increased 243 per cent., the total motor traffic has increased 661 per cent., while in 6 years the number of heavy trucks has increased 341 per cent.

In Iowa an interesting census was made in 1917, by the Engineering Experimental Station of Iowa State College, from 7 to 10 days. Scales were set up covering one half of the width of the road; a huge sign was put across the road and the driver of every car was belted and interrogated. This census enabled the State to ascertain.

(1) Total number of vehicles;

(2) Character of traffic, whether farm, interurban or tourist;

(3) Percentages of horse-drawn and motor vehicles;

(4) Tonnage of traffic;

(5) Width and character of tires.

In 10 days in June, 1917, near Ames, Ia., on Ames-DesMoines road there passed a total of 1,995 vehicles, of which 647 were farm traffic, 1,227 interurban, and 121 tourist. These vehicles carried 1,561 passengers, and weighed 4,919,456 pounds gross. Of the total number of vehicles 1,752 were motor vehicles and bicycles, and 243 were horse-drawn. The exact basis of farm and interurban traffic was difficult to determine, but it was considered that farm traffic included traffic originating or terminating at the farm, or doing business in passing, e.g, mail. Thus 32 per cent. was farm traffic, while 84 per cent. was local, i.e. between Ames and DesMoines.

Some American cities favor three enumerators at one station, one man to call out classification, the second to mark down the tick, and the third as relief man. This allows for a continuous count to be made in shifts, one man resting.

In the United Kingdom, methods may be illustrated by a traffic census on the roads radiating from Stirling, Scotland, taken in August and September, 1914, covering 16 hours a day, (6 a.m. to 10 p.m.) for 7 consecutive days.

An assumed average weight was given to each type of vehicle and the width of carriage way being given, the total weight in tons per yard width was ascertained. This assumed weight differs very little from that used in the Massachusetts censuses.

In London yearly censuses are taken on such thoroughfares as Fleet Street and Putney Bridge for 12 daylight hours on one day, and are chiefly used for determining density of traffic rather than wear to pavement.

Traffic Regulation

Traffic regulation, it has been suggested, is a matter in which traffic data may be of service. "Build the road for the load" is advice commonly heard. As a phrase it has a sound that appeals. That is, they tell us not to limit the load, but to put an unlimited expenditure into the construction and maintenance of the road. If any unlimited load can destroy or injure a road, it is to be taken as evidence that the road and the man who designed it were at fault. In British Columbia, a case was recently in the courts in which damages were sought for the destruction of a concrete pavement. A lumberman had put a stick of timber weighing forty tons on a truck, and had broken every slab of concrete pavement over which the load passed. This lumberman no doubt held the view that "the road should have been built for the load."

Truck owners in Ontario have told the speaker of instances in which their vehicles carrying ten or twelve ton loads, particularly in the early spring, have made ruts four to five inches deep, and ten to twenty miles long, in a single trip over a gravel or macadam road. This information has been imparted by the truck owner cheerfully, and evidently without realization of the thousands of dollars of injury which they have done to make fifty dollars or less. The attitude of the truck owner when considering a trip over the country roads is apt to be merely one of, "can we get through?" Damage to the road in so doing is a matter which has not been brought to his attention.

Light traffic is largely a question of durable surface, with sufficient foundation to resist minor but frequent strains of impact. Heavy truck traffic demands not only a durable surface, but a heavy foundation.

The maximum weight of load is an important factor, and one which must be determined before the highway engineer can reasonably be asked to design the roadway. Recent legislation in Ontario has limited the maximum weight to 12 tons, including load and vehicle, with 4½ tons on any wheel, and 650 pounds per inch of tire. During the months of March and April, the load for a motor truck is limited to one half the carrying capacity of the rated vehicle.

Definite Data Needed

Highway design, as previously stated, is necessarily based on traffic. Traffic data and information as to the behaving of various details of design under different ranges of traffic, are therefore necessary to scientific and rational design. Highway transportation is in a condition of flux, and an immense growth may be anticipated in the next decade. Much data of value in road design is now available, but engineers and road authorities can render this work a valuable service by assisting in the task of accumulating definite results, in order that "trial and error" methods may finally disappear from this important branch of public works.

Value of the Local Association in a Nation-Wide Highway Movement

"Co-operation and Co-ordination" is the Watchword to be Kept in Mind When Developing Good Roads Sentiment—Canadian Good Roads Association to Crystallize the Thought of All the Local Associations and Secure Uniformity of Action

By Wm. Findlay, Business Manager, The "Globe," Toronto

TODAY Canada stands on the threshold of the greatest development in her history, and if the plans now in hand are carried to completion it is hard to conceive that this country ever again will have to devise a highways project which will be comparatively so novel, so bold, so extensive, or of such cost. I do not mean that present plans for road-building are the greatest which will ever be undertaken by the provinces or by the Dominion. Far from it. The era of road-building upon which we are now entering is going to be permanent. It will, we hope and confidently expect, never be ended. For all the highways never will be built, so long as human effort falls short of human ideals.

But I do mean that this country will never again be confronted with any general national road-building program which will involve so great a change from existing conditions, and which will be so much in line with the most advanced thought among good roads advocates, and by the same token, so far in advance of the thought of the general public on the necessity for improved highways.

Perhaps it may be that at this present time my feeling is akin to that of the people of Ontario when, twenty-two or twenty-three years ago, it was suggested that a million dollars of Provincial money should be set aside for road-building, the municipalities contributing a proportionate amount. Politicians stood aghast at the size of the project to spend this amount of public money, even though it was to be spread over several years. Before it was thought safe to entrust the proposition to the Legislature it was necessary to have a public inquiry, and the wardens and reeves were brought in from the counties and townships—not particularly to ask them what they thought of the scheme, but by the discussion of it to familiarize them with the movement, and to secure their support in their various communities for what was considered a stupendous movement in the direction of better roads.

Leading Roads Under Control of Large Government Bodies

And what was the great sticking point with these legislators next after the size of the money vote they had in mind? The question was whether, in the interest of economical construction, better maintenance and the securing of through routes of travel, the townships could be induced to turn over to the counties a number of their leading roads.

Just at this time, that great missionary of better highways, Mr. A. W. Campbell, entered upon his official connection with the government of Ontario. He went up and down the province, holding meetings here and meetings there. Little meetings they were, held in the schoolhouse or township hall. I have heard him tell of the half dozen or half hundred progressive farmers who would attend, and of how the gospel of good roads was propagated, and always the subject of his thesis was to get the leading roads under the control of the larger governing bodies. That has been his effort for twenty-five years. It was crowned in Ottawa last year when the Dominion legislation was passed and the leading roads of all provinces, and connecting the principal centres of the east and west, may now come under a measure of control of the federal government and receive federal aid.

The process of education by discussion, started by the inquiry I have spoken of, was carried on in another way, and a more widespread way, because many men undertook the work. The Ontario Good Roads Association was an infant two or three years of age at that time. It is a veteran to-day, not too old to be vigorous nor too young to be inexperienced. Its members are the very class of men who make public sentiment throughout the counties. They are largely the men who represent the townships and the counties in their municipal affairs. No good roads association in Canada has a better record for progressiveness or continuous active service or for the faculty of translating thought into action than the Ontario Good Roads Association. I speak disinterestedly of this body because I have never been a member of it.

William Findlay

To-day in Ontario we are not discussing whether leading roads should be county roads or township roads, but whether they shall be provincial highways or parts of the federal system. That is the advance that we have made, and I contend that in so far as Ontario is concerned, this advance is due primarily to three causes: first, the educative work of the Provincial Highways Department inaugurated by Mr. Campbell, and so actively and successfully carried on by Mr. McLean; second, the increasing influence of the Ontario Good Roads Association and other more local associations, and the constant effect of the discussions which take place at their conventions; and third, the influence of the automobile, both the car owned by the farmer and the car owned by the city man.

Motor Leagues Stimulating Good Roads Thought

The motor leagues and associations have been great factors in stimulating good roads thought. They have convinced the people of the urban communities that good highways concern not the farmer alone, as we imagined twenty-five years ago. They have paid their good money for highway improvements to their various provincial governments in the form of automobile licenses—millions of dollars—and millions of dollars of it is still in the possession of these provincial governments, and has not yet been spent on good roads, I am sorry to say.

They have gone further, and have convinced the people of the towns and cities that it is a proper thing for them to contribute through their tax bills as well for good roads in the surrounding counties. The motor car owners of the cities have done a great and good work through their associations and leagues.

I do not wish to discriminate as between these two classes of organizations. Each has a field. Each has developed its corporation. Each is dependent for complete success upon the other. And it is idle in any section of the country where the two classes exist to expect to score 100 per cent. in the development of good roads thought without organization of the men of the rural communities and of the motor car owners in the towns, and then to secure active and harmonious co-operation between the two organizations for specific purposes.

What Was Accomplished In Eastern Ontario

In Eastern Ontario up to three years ago the good roads activity was represented largely by the Ottawa Motor Club and a few purely local good roads associations. Through the efforts of the Ottawa Motor Club and the organization they were able to get together along the route, the highway to the St. Lawrence at Prescott had been projected and promised. Other sections in that part of the province were clamoring in a disjointed way for better roads, but their efforts were ineffective because there was no broad general program in which all could join.

Most of the roads concerned led into the city of Ottawa. The problem, so far as that city was concerned, was insurmountable until the toll gates which confronted the traveller on every leading road near the Capital could be taken down and the privately-owned highways could become the property of the people and subject to public control. The question had been on the boards for twelve years, and no progress towards a solution had been made.

The Eastern Ontario Good Roads Association was formed in the summer of 1918, and to the success of its initial meeting and of all the work it did, a great deal of credit is due to the newspapers, daily and weekly, of that part of Ontario. Publicity was the foundation stone of its success. The publishers came at their own expense to a meeting held for that purpose, and pledged their support to the movement, and they gave that support willingly and without stint. It was a movement purely public in its nature, but it embraced the selfish interest of practically every town in which a newspaper was published.

The support of the municipalities was sought and secured. They sent their men as delegates to meetings, and they contributed their money.

The policy of the Eastern Ontario Good Roads Association was to urge the erection of all roads in that part of the province as provincial highways or provincial county roads. The provincial highways along the St. Lawrence and from Prescott to Ottawa had been decided upon, as well as the provincial county road from Morrisburg to Ottawa. To these roads, largely as a result of the activities of the Eastern Ontario Good Roads Association during 1918, there were added as provincial county roads, three other highways: one following the Lower Ottawa River to the border of the province of Quebec; another traversing the Ottawa Valley northerly to the town of Pembroke, and a third crossing through the Rideau lakes country and the agricultural sections of Leeds and Frontenac to the city of Kingston. The petitions for these roads, prepared and circulated by the Eastern Ontario Good Roads Association were signed by over seven thousand ratepayers, and adopted by numerous municipal and commercial bodies.

Enlisting Ottawa Co-operation

But another, and even greater accomplishment, was that of bringing the city of Ottawa and the county of Carleton together in the establishment of a Suburban Road Commission under the law of Ontario. Ottawa was the last of the large cities in the province to take advantage of this legislation, although perhaps it contained more good roads sentiment to the square yard than any other city. Because of the outside influence which the Eastern Ontario Good Roads Association was able to exert, the city and the county got together and adjusted their difficulties. The Suburban Road Commission was formed, the toll gates came down, and now Ottawa is in a position, as she never was before, to give an entrance to permanent highways connecting with other centres in all directions, and will become, as she has a right to, the highway centre of the eastern portion of Ontario.

The work of the Eastern Ontario Good Roads Association was not confined by any means to the hard roads. A great deal of discussion at its meetings was devoted to the township and county problems. It was a cosmopolitan institution, ready to consider highway problems of every character, and it therefore received the support of all classes of good roads enthusiasts. It believed that the people on every concession were entitled to easy access to the permanent roads.

All big movements in Canada must have their roots widespread if they are to be successful. An association like the Canadian Good Roads Association can be powerful only if back of it there are local good roads associations in every province and in every section of the province. It may be considered that this suggestion contains the thought of selfishness, and that I am advocating the organization of local associations only to take care of local needs or desires. If there were no local needs or desires in this good roads propaganda, there would be no propaganda. This is a practical subject. We do not advocate roads for any other purpose than because we want to use them, and most of us will get the greatest use of the road nearest at home.

"Co-operation and Co-ordination"

The watchword of this convention is "Co-operation and Co-ordination." Co-operate with this national organization by forming your own local organizations, and let it help to co-ordinate the development of the good roads idea all across Canada in a way that only a national organization can do. Develop the good roads sentiment in your locality by a local good roads association. Decide what roads you want to improve. Lay out your program on broad lines, so as to merit as great a following as possible. Then start your educational campaign on general lines, but with the objective of securing the improvement of your particular roads. Get the motor car owners of the town joined up with the people from the townships. Connect up your local associations with your provincial association and let the members of all the associations join this Canadian Good Roads Association and co-operate in its work, Let this association be your clearing house. Let it be the body which crystallizes the thought of all the local associations, and secures by co-operation that uniformity of action which a nation-wide movement demands. You will strengthen immeasurably the Canadian Good Roads Association and place it in a position where it can be of even greater service to the cause, and more thoroughly representative of good roads thought of every character and in every portion of Canada. You will help to form and you will be an important part of a closely-knit fabric of good roads ambition and attainment which will extend from one end of Canada to the other. You will prove the "Value of the Local Association in the Nation-wide Highways Movement."

Progress in Purification of Toronto's Water Supply

By N. J. Howard

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tested for excess chlorine every hour. The plant is so operated that it is impossible to overdose the water, the minimum quantity actually necessary being applied automatically. Samples of water after sterilization are examined every four hours.

For the present condition of the Toronto water supply the citizens must thank those civic officials who by their progressive policy have done so much to rid the city of typhoid fever, and to supply them with a safe and palatable water equal to the best on the American continent. Amongst those who will always be regarded as the pioneers of water purification in Toronto are ex-city engineer C. H. Rust, waterworks engineer C. L. Fellows, commissioner of works R. C. Harris, Dr. C. J. Hastings, medical officer of health and Dr. G. G. Nasmith, ex-director of laboratories, who did much to perfect the system of chlorination.

Northern Architectural Iron Works

The Northern Architectural Iron Works, Montreal, which was recently organized, is now operating under the joint management of Messrs. J. G. Frost and Angus McLeod. Mr. Frost is thoroughly conversant in all branches of this work, having been local superintendent of the architectural bronze and iron works department of the Canadian Allis-Chalmers Limited, Montreal, for a number of years. Mr. Angus McLeod, who is associated with Mr. Frost, was formerly forge superintendent at the Rockfield plant of the Canadian Allis-Chalmers Ltd. The plant is equipped with the latest devices for manufacturing everything appertaining to architectural iron.

The Hull Construction Company, Limited, has been incorporated with a capital of $119,000, chiefly to carry out the provisions of the Quebec Workmen's Dwellings Act.

Education of the Highway Engineer

The Scope of the Good Road Movement is Creating a Demand for Trained Engineers—The Highway Engineer Must be a Specialist but He Must Have More Than Technical Knowledge—The Function of the University in Training the Highway Engineer

By Brig.-Gen. C. H. Mitchell, C.B., C.M.G., C.E., Dean of the Faculty of Applied Science and Engineering, University of Toronto

THE development of our highways has acquired such prominence that these are now amongst our most important public utilities. With the greatly increased activity in the construction of our highway systems, whether municipal, provincial or national, we find ourselves examining into our preparation and our facilities for the carrying on of these highly necessary and important undertakings. In this preparation we are beginning to realize that provision for adequate engineering with its many branches stands much in need of attention from all of us who are concerned in these utilities and we realize that if we are to proceed along sound lines for the development of our highways, we must be assured that a sufficiently large number of trained engineers, of the several types required, are forthcoming to carry on the work in its various phases. Too much importance cannot be attached to the quality and training of those who are to be intrusted with the engineering of our highways.

As we look forward to the future of highway engineering for the next decade or more, we can see that there will be a very considerable demand from all parts of the country for engineers trained in these various branches, and when the diversified form of engineering is considered, we realize at once that the field to be supplied is larger than at first appears.

Highway Building is an Engineering Problem

There was a time not many years ago—and most of us can remember it—when in regard to policy, construction and financial aspect, our highway undertakings were altogether different from those of today. In those days it was thought that but a small portion of the work lay within the province of the engineer and as a consequence, but few engineers were engaged in highway work. But this has changed. The development of province-wide programmes of road building, the demand for permanent roads of a high class, the employment of materials of road construction as various as the regions in which they are built, the inclusion in every project of numerous interconnected problems of engineering concerned with other public works and the introduction of motor transport on a scale hitherto unthought of, have all brought about increasing demands for technically trained men—whether we call them highway engineers or not—who are thoroughly essential not only to the construction of good roads but to their efficient and economical maintenance.

Wide Experience Is Necessary

To those actually engaged in the larger construction of our highways in our municipal, provincial and national programmes, the necessity for wide experience on the part of their engineers must be increasingly apparent and it is more than ever essential that their particular fitness for the various special branches of engineering should be assured.

The diversity of these various branches or special kinds of engineering which are now included or necessary to the broad subject of road building is not fully appreciated by the public nor indeed by but a few of those outside of the technical services, engaged in the work itself. There was a time when a road or highway was just the roadway itself, so far as the engineering is concerned and it was treated in this light, and roads were built or grew and were maintained, if at all, with the employment of the simplest engineering methods or the application of but the most elementary principles of applied science. But nowadays, like all other similar undertakings, the complexity of today's requirements and life has laid a much greater burden on those who are charged with the carrying out of the technical side of highway construction.

Brig.-Gen. C. H. Mitchell, C.B., C.M.G., C.E.

For instance, we naturally think of highway work as a branch of the broad subject of civil engineering, and so it is. But when one considers at length the various features involved not only in the actual road building but the closely related problems which accompany it, it is found that, as an engineering question, the so-called specialty embraces many features of other branches of engineering, such as mechanical, chemical and even electrical, with all of which the well-informed and broadly trained highway engineer should have no small acquaintance.

It is not sufficient that the civil engineer engaged in highway construction should have a good experience and ability in land survey work, topography, cross sectioning or mapping, or skill in the location and the balancing and computation of quantities involved in excavations and embankments or in grades and drainage or in foundations, or aptitude for the patient and laborious attention to office detail which goes with a well organized engineering staff. But he must also have a degree of experience in the design and construction, perhaps even to the extent of being an expert, in steel and concrete bridges and culverts, in retaining walls and those many concrete structures incidental to roads of all classes. To consider the subject broadly, he must be also a student of meteorology and understand the climatic conditions and their effects and he must know something of geology and even of petrology where so concerned with the qualities of road metals. If he is concerned with paving and roads and streets in closely settled areas, he has a highly specialized field before him in the study of the sources, properties, preparation, construction, behavior and maintenance of all kinds of paving material from gravel and stone to wood and asphalt. But that is not all for he must be prepared at all times, where building such roads and streets, to deal with the continuously occurring problems involved in taking care of water pipes and sewers, of street railway tracks, of railway crossings and their protection and operation and of the increasingly difficult electric line crossings whether telegraph, telephone or high tension electric power lines.

Mechanical Knowledge Needed By the Engineer

But the engineer in this work if he is to be really up to it, must be more than a civil engineer for, as pointed out, he must have a knowledge of mechanical and electrical and chemical work as well to follow the present day progress. Not only must he be conversant with the underlying principles of traction but he must have a practical working knowledge of the mechanical and electrical machinery and equipment used in the processes of manufacture and preparation of materials and in the construction of roads. The varieties of such equipment, with the machinery for instance of handling materials in excavation, quarries, sand and gravel pits, and in the preparation of them by crushers and screens or the machinery used in construction, concrete mixers, road rollers, asphalt, tar and similar plants are in themselves such important factors in road building as to demand close attention and knowledge on the part of the engineers. But there is the other phase of the mechanical of which the road engineer of today must have more than a passing knowledge. He must know the various principles of operation and control of motor transport of all kinds from the touring motor car to the freight lorry and their effect upon his roads in all seasons and with the activities of the manufacturers of today he must also keep up with the rapidly changing types of steam, oil and electric vehicles.

The co-ordination necessary for electrical work in connection with streets and highways has already been indicated as to line crossings but it is no small matter in congested areas to deal with the complicated problems of electrical conduits in the road bed, overhead wires, electric lighting arrangements and the vexed questions of electric railway and their maintenance with regard to the road bed.

So with the chemical side of the work. There must be for the future a larger proportion of these engineers engaged in or with a knowledge of the chemical properties of the various soils and materials of road construction and of the chemical processes involved in securing, preparing and applying in construction, the various special constituents of tar, asphalt and other materials.

Planning of Routes

Another feature, which in this new country is now very properly claiming attention in highway construction is that concerned with the strategical planning of routes, either municipal or provincial, and the work of general design related to the broad principles of town planning. Much is to be made and is being made of this feature, and it is very desirable that the coming engineering generation should make it a part of their work of preparation. In doing this they should not lose sight of the artistic and aesthetic in their work of street arrangement and beautifying, in their boulevards and parkways and even in the long reaches of rural highways which are so attractive a feature in the roads of England and France, of which the soldiers in the war have pleasant memories.

But engineering and technical knowledge and experience is not all that the successful highway engineer of today and tomorrow will require. That will be only part of his professional equipment. He must be much more than a technical man. The nature of this work requires much of other knowledge and qualifications. He must have administrative ability, he must have vision, judgment, and tact and those most vital qualities which will enable him to deal with and co-operate with other men whether workmen or employers, foremen or contractors, salesmen or walking delegates, business men, ratepayers or politicians. For after all the business of the building and maintaining of highways today is largely business, administrative work with engineering closely mixed with it, and as we go on in our complex methods of doing things, the business and the engineering will become more interconnected and inseparable.

Highway Engineer is More Than a Technical Man

The highway engineer must, therefore, equally be an administrator, an economist and a co-operator with the business man, the legislator and the ratepayer. It is perhaps this part of his work which will make him the more valuable servant of the municipality or the state, but he will acquire that value only in so far as he can efficiently combine his engineering knowledge and experience with his adminstrative ability.

Now how are we going to secure these engineers? It will be said we ask for a super-engineer in this highly detailed specification of all he must be able to do. But why not, Is not our highway engineering going to be amongst the most important in the development of this country? We must then be prepared to meet the demand, and all those concerned in securing good engineers are equally responsible in the interests of good roads and highways.

The responsibility lies not so much on schools, colleges or universities as upon the municipalities and the governments who are building roads and highways. True, the colleges and universities must give the fundamental education but it is quite evident that the further or later education must progress in successive stages in the field, on the actual construction or in the engineering or administrative offices of the highway departments or commissions of the country.

The place of the college or university in this educative process is, however, well defined and the work they are called upon to do is in a large measure common not only to all classes of engineers destined to be employed on highway work but common as well to all sections of the country from coast to coast where this kind of work is being carried on.

Scientific Training a Large Factor in Success

The fundamental principles of applied science in respect to road building are the same everywhere and colleges can deal with all of the underlying principles already outlined under the various civil, mechanical, and other branches of engineering. It has been said that road building is an art rather than a science. That may have been true in the earlier days and even within our own memories but it cannot apply today. The work that has been and is being carried out in the universities of Europe and America shows conclusively that scientific training is today a very large factor in successful road building. In the work of research the University has a special service to render to the State and it will be found that as time goes on and the problems of road building and maintenance and of road operation and traffic become more complicated the processes of experiment and research in which the Universities can participate will be more than ever valuable to the road builder.

It is not the purpose here to enter into a discussion in detail of the form such college training should assume or to lay down a special curriculum for highway engineering. All the colleges and provincial universities of Canada are now giving such courses as will supply the coming highway engineer with more or less of the scientific side of his fundamental education. It is desirable, however, that more attention should perhaps be paid to some of those features of the more direct application of principles to road building and maintenance. In this connection I desire to bespeak a further co-operation between those connected with road building, either in municipal or government relations on those engaged in businesses connected with road materials or construction on the one hand and the universities on the other, so that there may be some mutual assistance in co-ordination of effort and in research work. The laboratories of the universities should be at the disposal of the municipality and government for these purposes and it is indeed the duty of the university to assist the state in every way in this respect.

More Than the Technical Required

The universities, however, must recognize what is already pointed out, that the education of the engineer of to-day does not stop at the technical work. They must supply the engineering student as well with some of the economic, financial and broader education which at least will fit him to carry on after he gets out into his life work.

When the young graduate leaves his college he must not by any means think himself an engineer, much less a highway engineer. He has much practical experience to get. If he is desirous of following highway work it is not necessary that he plunge into it as soon as an opportunity offers. There is much advantage to himself and his subsequent employers if he can get some other co-ordinating experience, such as, for instance, on railway work or general municipal work. Railway work is specially fitting for carrying on with highway work and we are now coming to learn that the engineering work of both is similar and equal in importance with the advantage lying with highway work for diversity. It is well, too, to keep in mind that so far as the present is concerned, there are many college graduates and other young engineers who have had the advantages of war experience on highway work, in road building and maintenance in France and in motor transport and traffic operation there as well, under difficult conditions.

But the duty of the state is larger than the university in this respect of education. All that the university can do is to provide the early fundamental scientific education and but a small portion of the special highway engineering training. The municipality and the state must do the rest if they are to secure the right type of useful highway engineers. They must be prepared to take the young University graduate or the specially trained or partially scientifically educated school or college boy and put him into their organizations in such a way that he will learn the other side of the work of the engineering. He must be given every opportunity to learn the practical, administrative and operative portions of the work in successive stages and only by this means will the state produce for itself a broadly educated highway engineer.

Keeping Highway Records

System of Filing in British Columbia Facilitates the Handling of Correspondence and Minimizes Office Staff

By A. E. Foreman, Public Works Engineer, Victoria, B.C.

IN connection with the organization of a highway department a satisfactory system of entering and filing correspondence should be inaugurated so that government business will be carried on with the same promptness and dispatch that obtain in a private corporation, and with some governments this is the exception rather than the rule. In British Columbia our method of accounting is based upon electoral districts and we have taken advantage of this to introduce a system of filing that is proving satisfactory and a brief explanation of which may prove of interest.

In the Constitution Act, the electoral districts are placed alphabetically and numbered accordingly, so that Alberni is No. 1, Comox No. 6, Trail 36, and so on. We have then taken arbitrary numbers to represent the different classes of work—20, for example, represents roads; 40 represents bridges, and 50 represents ferries, and I may add that in British Columbia the highway department is a branch of the public works department and the other numbers represent other classes such as public buildings, wharves, river bank protection, etc.

Every individual road, bridge and ferry in each electoral district is numbered which fixes it definitely although it may have a number of local names. The result is that 1-20-32 is Alberni district, road number 32; 6-40-75 is Comox district, bridge No. 75; 36-50-4 is Trail district, ferry No. 4 and so on and these numbers not only fix definitely the road or bridge, but they are also the file numbers under which correspondence on the individual roads or bridges is filed in the different offices. When a district engineer is writing about a certain road, the number of that road is also his file number as well as that of the office to which he is writing. The results are that it facilitates filing, gives the head office a check on how the system is being kept up in the outside offices, gives uniformity throughout the province, and when an assistant is promoted to another district, he is at once familiar with the filing system in use in that office. By introducing this system and making other changes at the head office, we were able to reduce the staff and still handle a 30 per cent. increase in the correspondence, and what is more important, answer it promptly.

Financing a Provincial Highway System

The Possible Sources of Revenue and the Merits of Each—If Road Expenitures are to Appeal to Public, There Must be Assurances That They Will be Made Prudently—Determination of Motor Fees—Calculating the Justifiable Expenditure

By A. W. Campbell, Dominion Commissioner of Highways

WHAT is a Provincial Highway System? The answer depends largely upon the authority and powers of the department in each province having the administration of its highways. In the provinces of Prince Edward Island, Nova Scotia, New Brunswick and British Columbia, all roads, both as to construction and maintenance, are under the jurisdiction and control of the central provincial government. Consequently, a provincial highway system in these provinces embraces and includes by-roads and side-roads as well as main or trunk roads. A centralized form of administration of highways in these provinces is, therefore, necessary. Now, if Nova Scotia may be taken as typical of the provinces having a provincial highway system of this type, we find that their "Provincial Highways Fund" taps six distinct sources of revenue, as authorized by their "Public Highways Act of 1917." These are. (1) such sums as may be determined by the governor-in-council not exceeding the amount voted by the legislature of the province for the purpose; (2) all motor license fees; (3) all sums contributed by the Federal Government to encourage and assist the improvements of highways; (4) direct taxes on ratable property and income amounting in cities and towns to one mill and in other municipalities to four mills, together with a poll tax of $1.00, or if not assessed, a poll tax of $3.00; (5) certain income from crown lands, and (6) special contributions by municipalities, corporations, associations or persons.

Revenue From Federal Sources

At the present time, each of these sources of revenue, with the possible exception of the direct taxes, are now available and open to each of the provinces of Canada. This statement could not be made when the provincial legislation of Nova Scotia just referred to was passed, because the Canada Highways Act, which appropriated $20,000,000 to encourage the provinces in constructing and improving their highways, became law only on July 7th, 1919. This Act makes available to the different provinces 40 per cent of the cost of constructing or improving such highways as the provinces designates to come under the Act, the provinces subsequently to submit such information regarding the public necessity of the various highway projects and as to location, cost, description, specifications, time and method of construction, as is satisfactory to the Federal Government. The regulations under the Act stipulate that this information shall be submitted in what we term a "project statement." This statement includes information as to the authority for and sources of provincial and local funds, where such funds are to be used in connection with any project.

At the present time, direct property tax including the poll tax for highway purpose is exigible in Canada only in the provinces mentioned as controlling all their roads. While such tax levies for highway purposes usually go into the general fund of these provinces, this source of revenue may be capitalized and the proceeds expended on roads of a particular class. Such highways generally embrace the main trunk roads connecting the principal centres of population and distribution, linking up a series of market roads. Generally speaking in the central provinces, that is from British Columbia to New Brunswick, this class of roads constitutes what is commonly known therein as a "provincial highway system." In these central provinces all direct property taxes, including those for road purposes, are collected and spent by the various municipal councils of each province. There is no gainsaying the fact that there has been a strong disinclination in such provinces as Ontario to institute direct taxation for highways or indeed, for other purposes. Insofar as the setting aside of motor fees for highway construction is a form of direct taxation, there has been a departure in such provinces as Ontario from the indirect methods of taxation. Indeed, the development and expansion of motor transport has been featured by a tendency toward this form of direct taxation in all parts of America; and in the provinces not already having control of all their roads, there has been a further marked tendency towards centralized administration of such highways as are used to the greatest extent by motor transport.

Direct Levy on Property and Income

In the United States a direct annual levy, collected by the State on property and income, for general highway expenditures or for highway debenture, is very common even in such states as New York in which the counties also make large expenditures on their highways. The fixed state tax levy varies from 1/10 of a mill to 2½ mills. For highway debenture issues, the direct levy, of course, varies according to the amount issued and outstanding, that is, without having regard to the term of the issue or the rate of interest payable. The law of New York state regarding its last issue of debentures for highway purposes provided that the rate of annual tax be 5/1000 of a mill of valuation of real and personal property subject to taxation, for each $1,000,000 issued or 1/10 of a mill for a $20,000,000 issue. This method of raising highway funds has the advantage that the large cities of the province or state are called upon to make a definite contribution toward the financing of the leading highways therein; it thereby lessens the burden of providing adequate highway transport for long distance travel, formerly imposed on local units.

Any provincial highway system fundamentally involves a classification of the roads in a given province, followed by the selection of those which carry the heaviest traffic and serve the most people for special treatment. In the case of provinces in which the counties or similar units control all roads, it means special legislation under which these highways are designated to come under complete or partial control of the central government.

Safeguarding the Expenditures

In this connection, it may properly be contended that, prior to the proper classification of the highways of a province, there should be established in each province a department or branch of a department with trained experienced engineers in charge, whose judgment regarding the engineering problems affecting proper locations, designs and materials for road construction, will command the confidence and support of the public which pays the shot. The man on the street quite naturally feels that any large sum of money raised for the special purposes of building the roads demanded by the modern road-vehicle, should be regarded as a public investment to be safe-guarded. If this investment is to appeal to the public, there must be a reasonable assurance that the contemplated expenditures will be made prudently. The people want to know that their money will not be scattered around on job and patch work but that proper care will be taken to secure the best location, firm foundations, thoroughly drained and consolidated, and with surface coverings economical justifiable. In this connection I am pleased to be able to state that all the provinces of Canada have already established highway departments or branches which are under the direction of experienced, competent engineers acquainted with modern methods of road construction and at the same time fully alive to the limitations of local conditions. The ground, to use a figurative expression, is in this respect already paved and prepared for a superstructure of solid achievement in highway work.

A. W. Campbell, Dominion Commissioner of Highways

In passing, perhaps, I might state that possibly the best evidence that the provinces now have capable highway organizations, which have been applying themselves to the task of classifying their roads, may be found in the fact that eight out of the nine provinces have, to date, submitted to the federal government for approval, a programme map of a selected system of highways in these provinces for construction or improvement under the Canada Highways Act. This means that these provinces have chosen the roads of the most general and local importance, in each, for improvement with federal co-operation and assistance. The total mileage of the roads that have been so far designated as federal aid roads is about 18,000 miles; and the total amount that is being raised by these provinces and which will be applied during the next five years on this system aggregates about $73,000,000. Consequently it would appear that the manner in which this vast sum of money is to be obtained for highway purposes is a very pertinent question at the present time.

Now experienced highway engineers fully realize that and highway improvements in grading or preliminary work, undertaken from special expenditures, should be done only with the view to the laying of foundations that will meet all reasonable requirements of future traffic; and that any gravel or stone should be applied with the view to making a suitable surface to accommodate the present requirements of traffic and to fit into a finished work later on, even if that work should be of the most expensive class of pavement. Public confidence in special highway debentures would be more secure if the people were taken into the confidence of highway engineers as to the manner in which the work is to be carried on, to a greater extent than has been done in the past. However, it is a well known fact that engineers are not good advertisers. Still there is a public which looks for immediate results, forgetting that only the cheap and most impermanent structures are built in a day, and which should be informed as to what is intended.

Financing Large Expenditures

Now let us briefly consider what is the general trend of methods of financing large special expenditures on highways. In the past, road work was but one of several so-called public works receiving attention of a provincial department of public works. All expenditures made by such departments were usually met out of the general funds of the province. Of late, however, there have developed in practically all of our provinces special departments to deal with road matters which, in order to satisfy the public demands for improved roads, require extraordinarily large expenditures. Since these expenditures are made largely in response to the demands of a limited portion of the public, namely those using the roads or living adjacent thereto, a tendency towards financing the necessary expenditures from direct taxes on real property, motors or gasoline or from capitalization of prospective revenues from these sources in the shape of debenture issues is very strong. This method of finance has its merits. While not forgetting that there is a very great general public interest in improved conditions, owing to the decreased cost of hauling and hence a reduction in the cost of farm products, etc., to the consumer, yet it is undoubtedly a very equitable arrangement by which those benefitting directly from improved road conditions are called upon to pay the bulk of expenditures on the selected system of trunk highways placed under provincial control. It permits of the ordinary sources of revenue being applied to the lesser important roads, while a definite programme of permanent construction is being carried out. Because debentures have in the past been issued for highways and other public works and have failed because the proceeds have been spent in constructing hard surfaces on unimproved grades without proper foundation and drainage, is no reason for condemning the principle of capitalizing a given source of revenue for highway purposes.

Moreover, it is a mistake to secure a large highway bond issue on the pledge of the entire revenue from motor license fees for the construction of an extensive mileage of expensive highways, unless there is or will be an assured adequate fund from other sources for maintenance purposes. Good business methods demand that provision be made for protecting the investment by proper methods of maintenance.

Determination of Motor Fees

While many states and several of the provinces of Canada are devoting their revenue from motor licenses towards the financing of special expenditures on their roads, it would appear to be timely to consider briefly the basis on which the fees are collected from motor owners. At present there is little uniformity in this regard. One province may levy a flat rate upon all vehicles, whether used for touring or commercial purposes, having no regard to weight or horse-power. Another province may distinguish between commercial and pleasure vehicles on a flat basis while its neighbor may base the fee upon both weight and horse-power. Possibly a more equitable plan would be to have regard to each of these factors. In this case, the fee would be based somewhat as follows: 1/3 on power, 1/3 on weight and 1/3 on valuation or as a flat tax. There is no doubt that the tonnage and speed of any motor vehicle have a direct bearing on the amount of damage done by the vehicle to highway improvements, and should be taxed accordingly. A proportion of the fee based upon the assessed valuation of the motor vehicle would appear to be a fair means of taxing personal property that is not productive. However, it is doubtful that this method of levying the fee would be generally acceptable, especially in the central provinces.

In the state of Minnesota what is known as the "Babcock plan" of financing a trunk road system contemplates raising the motor fee to $18, which is now about one-half that amount, and pledging the extra amount so raised for the creation of a special bond issue, limited in any calendar year to $10,000,000, with never more than $75,000,000 outstanding. The greater part of the revenue derived from motorists now consists of a personal property tax in each, payable to the state. The average assessed value of all cars listed on May 1st, 1918, was $140 per car and the average tax on this assessment was $5.60, amounting together with a license fee of $1.66 to $7.26 only. The "Babcock Plan" will, it is claimed, not add a single dollar of taxation to the current expenditure on highways in the state. It would appear that this method of financing highway expenditures is satisfactory all around, providing the motor owners do not kick. Further, that the motorists of the state will have nothing to lose by this increased tax is sustained by the argument that the improvements will occasion them 20 per cent. less expenditure to operate their cars than at present.

A Tax On Gasoline

It has been estimated by an eminent French highway engineer that there is a reduction of one-third of the amount of gasoline required in driving over improved roads. This fact that the amount of gasoline used in a car is fairly proportionate to the excellence of the roads covered has been used as the basis for contending that highway improvements might properly be financed by a tax upon gasoline used for motor purposes. A tax of this nature would be somewhat difficult to collect. Each province would require that the owners of garages and gasoline supply depots give affidavits as to the amount of gasoline received by them and sold to the public for motor purposes. However, owing to the extraordinary increase in the price of gasoline within the last year, there is, no doubt that a tax of this nature would not be very popular with our Canadian motorists. As a measure of alleviation of the rising cost of gasoline, it has been suggested that the provincial governments should take over the control of purchases and sales of all gasoline used for motor purposes. As "The Nation" (N. Y.) puts it—"Why not one fluid more? Why not the one fluid that makes the motor world go round, whose very drops are the touch of nature which makes the whole world spin?" If the tax on gasoline could be collected without too much trouble and expense, it would be a very fair means of arriving at the amount of service which motorists receive from a provincial highway system, and of reimbursing the public for the amount of wear and tear caused to highways by motor vehicles.

Justifiable Expenditure

With regard to the amount of expenditure per mile of road that a debenture issue is to cover, it may be said that, providing the actual tonnage of traffic now using the road as well as the approximate increase of traffic that will result from the improvement is known, the justifiable expenditure can be quite readily determined. All that is required is a calculation based upon the actual differences in the cost of hauling one ton for one mile over the various classes of roads. For instance, supposing the difference between the cost of hauling one ton for one mile is 10c greater over an orlinary earth road than over an improved gravel road, or in other words that there is a saving of 10c per ton mile in hauling over the gravel road, and that there is a daily traffic of only 5 tons amounting in a year of 300 working days to 1500 tons. The result is clearly a gain of $150 in the cost of hauling over this mile during the year. Now, suppose you capitalize this annual saving with interest at the low rate of 5 per cent. and assume that such a saving continues for twenty years then the amount of highway expenditure that is economically justifiable on this mile is $3,000. On the same basis, there might properly be expended on a road carrying a daily traffic of 50 tons the sum of $30,000, and so on according to the traffic. Hence it would appear that the traffic a road is required to sustain is the determining factor in the amount of expenditure to be made thereon and of the amount of debentures required for any given stretch of road.

Selling Road Debentures

In conclusion, I might briefly touch on the question of the best way to sell highway debentures. Owing to the prevailing high rates of interest, it is desirable to sell an issue as cheaply as possible. This, of course, is usually done by asking for competitive bids but there is a further consideration in connection with highway expenditures, namely, the desirability of offering debentures of this character to the public as a worthy enterprise that should be taken up and promoted from the standpoint of patriotism and the general public interest. While Canadians are prone to smile at some of the so-called amendments to the constitutions of some of the American states owing to their having relation to matters of essentially passing importance, there is this much to be said for an amendment to a state constitution proposing a debenture issue for highway purposes, that the public become informed as to the nature of the benefits accruing from improved highway conditions, and a lively interest is secured in promoting the welfare of the country in this regard. Our provinces are not in a position to amend their constitution periodically by popular vote. However, there is no good reason when debentures for highway purposes are being floated that an active campaign should not be instituted to help in selling them, setting forth the expected benefits to be derived from the expenditure proposed and urging popular support to the debentures on the dual grounds of patriotism and good business.

Saving Roads by Oil and Carpet Coats

Old Roads May be Given New Life by Proper Surface Treatments—Bulk of Roads Can be Thus Preserved, Maintaining in This Way a Policy of Strict Economy—Rules for Laying Bituminous Coatings—Outremont's Experience

By J. A. Duchastel de Montrouge, City Engineer and Manager, Outremont, P.Q.

THE road builder is face to face today with problems which were of little concern only a few years ago, viz: the scarcity and efficiency of labor; and the high cost and difficulty in securing materials for road construction. He has, therefore, to apply himself in making the best of a difficult situation, and his duty is to counteract the general tendency of extravagance in road construction, and devise means by which old roads can be restored, improved and maintained until such time when prices come down and labor is more plentiful.

Many miles of old macadam or gravel roads can be improved at a small cost, and a surface treatment applied to them, thereby prolonging for years their usefulness and retarding for considerable time the construction in their stead of pavements of a more permanent character.

Improved Roads Save Transportation Cost

Another very important economical question to consider, when the improvements to the roads of a district are planned, is the saving in dollars and cents on the cost of transportation of farm produce and merchandise generally. The U. S. Department of Agriculture, in its Country Crop Report for 1918, states that the cost of handling one ton per mile of farm produce in states having improved 25 per cent. of their highway mileage, was 10c, while in states were road improvement to the extent of 5 per cent. only had been made, the average cost price per ton mile was 30c. This needs no further comment. All I might say is that if only one-half the amount of money lost by the lack of maintenance in this country were spent on real maintenance, it would be unnecessary to worry for the future.

The greatest of all problems on road construction today, after drainage, is road maintenance, and too little thought is given to this matter. We are all accustomed to maintain our buildings, our equipment, ourselves, this has been drilled into us for long, but too many people imagine that once a road is down, it is down forever without further care, but this is absolutely wrong. The maintenance of a road should start the day it has been completed.

Bulk of Roads Can be Oil Treated

The present situation warrants a true policy of the strictest economy, and outside of some main trunk roadways in close proximity of one or two cities, the great bulk of our roads should be improved and treated in the manner I am about to describe.

In "Good Roads" on March 24th, 1920, in an article entitled "Improved Roads from the County Official's Standpoint" signed by J. Charles Dayton, County Superintendent of Highways of Cayuga Co., N. Y., a question from an article written by Colonel W. D. Sohier, reads as follows:

"In Massachusetts there are many miles of waterbound macadam from 13 to more than 20 years old, scattered around in all sections, which have never been resurfaced but have been maintained with a bituminous blanket top and constant patching. Others have been satisfactorily maintained by putting a thin mixture of sand and asphalt on top and widening the shoulders with the same material, only 3 or 4 inches in depth, at the same time diminishing the crown."

Capt. J. A. Duchastel de Montrouge

These excellent methods in road building adopted by one of the leading states should be an inducement for us to follow suit.

It would be unwise to believe that surface treatment with a bituminous material will conjure all evils from any road. While it is admitted that a surface treatment with bituminous material is a ready means of salvaging many types of pavements, on the other hand, it must be remembered that the road to be treated must have a foundation of sufficient strength to sustain the traffic it is called to have; that the drainage must be good, and that the road surface must be in good condition. No surface coat will last if these conditions are lacking.

Surface Treatment is a Preservative

The surface treatment must be considered as a preservative in the same way as a carpet over a hardwood floor, and the carpet coat has got to be removed from time to time in the same manner as a carpet over the wooden floor.

Under the title of "Road Oils and Carpet Coats" mention should be made of the dust laying oils of asphaltic or tar origin. I will say very little on these, as this type of oiling is intended simply to weight down the dust particles and prevent them from blowing away. These light oils do not, as a rule, form a protective coat as the heavier ones used in connection with carpet coating. In many cases, far from protecting the surface of the road, these light oils have introduced an element of lubrication in the upper layers of the road surface with the result that disintegration often sets in faster than it would normally.

A sure indication of wear on a road is the presence of dust. A bituminous carpet coat, if properly laid, will stop the appearance of dust and will preserve the road both from wear and from the disintegration due to the presence of water. It will render the road practically impervious.

Carpet Coat is Heavy Treatment

The bituminous materials used for a carpet coat should be heavier than those used for dust laying. They should be asphaltic oils containing from 60 to 80 per cent. of asphalt, or refined tars containing few or no constituents distilling at a temperature of 300 deg. F., the idea being to lay over a road a heavy material containing no volatile base or residue and which will remain on the surface of the road forming a mat or carpet with the coarse sand or stone chips. Care should be taken to avoid building too thick a carpet, in which case, rolling or waiving of the surface would shortly appear. It must be remembered that the tendency of the horses' shoes and steel tires is to cut up a surface of this nature, but if the proper kind of material is used, this defect will be overcome by the ironing action of the rubber tires of automobile traffic.

In determining whether an old macadam or gravel road should receive a surface treatment, the traffic census should be taken, and if it is found that over two hundred automobiles travel over this road a day, it becomes imperative to treat this road with a bituminous coating. If the road is in good shape, and the coating properly applied, then this road can carry up to two or three thousand automobiles per day during the summer season.

Rules for Laying Protective Coat

Before determining whether it is wise to apply a bituminous carpet coat to a macadam or gravel road, it is necessary to investigate the following points:

1.—The nature and volume of the traffic over the road;

2.—The thickness of the metal composing the roadway itself;

3.—The nature of the sub-soil and its drainage.

If any of these items require attention, it would be a waste of money to treat the surface without remedying any of these faults.

In laying a carpet it is necessary to observe the following rules: All dust must be thoroughly removed from the road surface with brooms so as to permit an intimate adhesion between the road carpet and the road surface. For economy's sake it is advisable that a rotary horse sweeper be used. All the small depressions of the roadway in which dust might lodge should again be swept by hand brooms. The road surface should resemble a mosiac after the sweeping is done, and all stones should be exposed over the entire area.

The liquid bitumen should be applied after heating, and in moderate quantities. The quantity applied per square yard will vary from one-fifth to one-third of an imperial gallon, all depending upon the conditions of the road surface. All surplus bitumen will be swept with hand-brooms over the road, so as to avoid the formation of puddles, otherwise the carpet would be of unequal thickness and creeping of the road surface would soon take place. A couple of hours after the application of the bitumen, the surface should be covered with sufficient coarse sand or screenings to absorb all the bitumen.

No road oiling should be undertaken unless the roadway is absolutely dry, otherwise any dampness at the surface of the roadway might prevent the adhesion of the carpet. Unless perfect adhesion is obtained, the carpet is apt to break away in slabs during the cold weather.

I have had some experience myself in road oilings, and am pleased to state that the results obtained are far beyond my expectations. I find that the roadways that I have treated with road oils have been cheaper to maintain from year to year. They are easier to clean, they are dustless and mudless, and their appearance is most pleasing, resembling very much sheet asphalt surfaces.

Outremont's Experience

I am submitting herewith a few figures, showing the annual cost of repairs to roadways in Outremont for the past ten years, and also the cost of oiling these roadways. It will be noticed that the cost per square yard for repairs has decreased from 1910 to 1919 at the rate of 60 per cent., while wages have increased 14 per cent.

Cost of Street Repairs, City of Outremont

(permanent pavements not included)

Year	Total cost	Sq. yds.	Cost per sq. yd. Cents.	Average price of labor
1910	$8,866.81	124,945	7.1	$1.50
1911	10,557.79	157,595	6.7	1.75
1912	14,412.84	208,419	6.9	1.75
1913	11,773.45	244,474	4.8	1.75
1914	15,165.20	273,014	5.6	1.75
1915	18,928.88	300,734	6.2	1.75
1916	11,314.83	302,784	3.7	2.00
1917	12,817.86	322,604	4.0	2.50
1918	11,824.74	335,624	3.3	2.75
1919	10,204.00	337,374	3.0	3.00

Cost of Street Oiling

Year	Total cost	Sq Yds.	Cost per sq. yd. Cents	Imp gal. per sq. yd.	Average price of labor
1914	$ 787.42	3,000	2.6	. . .	$1.75
1915	2,624.80	101,930	2.6	153	1.75
1916	5,037.44	187,675	2.7	194	1.75
1917	6,331.21	184,340	3.4	187	2.50
1918	6,202.33	138,690	4.5	200	2.75
1919	3,648.00	120,860	3.0	131	3.00

Seventh Convention of Canadian Good Roads Association is One of Most Successful in Its History

In Point of Attendance and and Representative Character of Delegates It Has Been Unusually Noteworthy—Proceedings are Outlined Herewith—Papers are Printed on Pages 544 to 556 and 562 to 564

THE 7th Canadian Good Roads convention and exhibition was opened by the president, S. L. Squire, on June 1st in the Royal Alexander Hotel, Winnipeg. The president introduced Sir James Aikins, K.B., Lieutenant-Governor of Manitoba, who gave an address of welcome to the delegates. Sir James Aikins said "I welcome you because you have public spirit and have translated that spirit into public service by coming here from all parts of the Dominion to assist in furthering this great work of good road construction. In going back home carry with you the slogan of this convention 'co-operation and co-ordination' and use it in continuing your work of good roads and in assisting to unify the national spirit as you have unified the good roads policy of the country." In speaking of the necessity of good trunk roads, Sir James said he strongly supported this and was highly in favor of the movement for a Dominion Highway stretching from coast to coast.

B. Michaud, deputy minister of roads for the province of Quebec, conveyed the greetings of his province, following with a description of good road construction and its progress in the province of Quebec. For the development of the west he strongly advised Manitoba to get busy with a road scheme to connect up Manitoba with its neighboring provinces Ontario and Saskatchewan.

Premier Norris of Manitoba and Chas. F. Gray, Mayor of Winnipeg, also gave short addresses of welcome to the delegates and voiced their support to the work of developing the good roads movement.

Hon. F. G. Biggs, minister of public works, Ontario, gave a description of road construction by the Drury government and Hon. G. F. Grierson, minister of public works of Manitoba, told of the greater progress in this province and strongly emphasized the necessity of greater attention being paid to the matter of maintenance.

Other short addresses were given by Hon. S. J. Latta, minister of highways, Saskatchewan, and Hon. James H. King, M.D., minister of public works, British Columbia. Both described the difficulties of road construction in their respective provinces and the great advantages so far gained and to be gained by the continuation of their good roads policy.

A. W. Campbell, Dominion government highway commissioner, gave an explanation of the federal government good roads policy.

On the platform in addition to the speakers were Hon. V. Bowman, of the Ontario cabinet, Hon. B. C. Churchill, deputy minister of highways, Newfoundland, W. E. Parker of New Orleans, president of the Jefferson Highway Association, L. E. Allen, president of the Ontario Good Roads Association, L. C. Charlesworth, deputy minister of public works, Alberta, W. A. McLean, deputy minister of highways, Ontario, J. A. Duchastel de Montrouge, manager of Outremont, P.Q.

"This convention is the annual meeting of the biggest public-owned institution in Canada," declared President Squire in delivering his address. "We are all shareholders, and, as such, are personally interested in road development," and he added. "the highways of Canada are not only the basic but its most important means of transportation. We have a wonderful system of steam railways of a total mileage of 375,000. We have a mileage of highways no less than 350,000. The value of the land appropriated for highways together with the improvement thereon is not less than $750,000,000. These have been built with less government assistance than the private-owned steam roads have received. The value of the rolling stock, all private owned, is greater than the entire capitalization of Canada's railroads. The automobiles alone in Canada on January 1, numbering 325,000, are worth $500,000,000. Then the Canadian travelling public are carried two miles on our highways for every mile carried on our railroads."

Nation's Best Asset

After giving these statistics, Mr. Squire affirmed that our highways were the nation's most important asset. They were the handmaid of colonization and of land settlement. They did more to increase the value of the land products than any other factor. Poor roads, he claimed, added to the cost of living and destroyed the farmers' profit, and he quoted authorities in proof of his statement.

The road problems of Canada, the president said, were great and should challenge the attention of the best men in the Dominion. Our road mileage averaged one mile for every 22. In the United States it was one mile for every 55. Canada's sparsely settled areas made the country's road problems greater than the road problems of other nations, and the good roads convention was important because it advocated the improvement of that which made for unusual service. In no other movement was democracy so exemplified. Rich or poor, young or old, Canadian-born or foreign-born, dwellers in the city as well as dwellers in the country, all used the highways and all were benefitted by their improvement. Their work, he said, was important because improved roads broadened the vision, dissipated sentimental differences, and made misunderstandings more difficult to exist.

"This convention is necessary," he asserted, "as an inter-provincial clearing house. Provincial good roads associations and other associations are necessary, but this association affords an opportunity for men of all provinces to exchange ideas and experiences that may prove of great value. Some one has said: 'Roads rule the world, not kings or governments, not courts or constables, not ships or soldiers. The road is the only royal road in the line of democracy, the only legislature that never changes, the only army that never sleeps, the only court that never quits, the first aid to the redemption of any nation, the exodus from stagnation in any society, a recall from savagery in any time, the high priest of posterity, without beginning of days or end of life. The road is the umpire in every war and when a new map is made it simply pushes on in the great campaign of help—hope, brotherhood, efficiency and peace. Surely a great compliment, but deserved. The great common highway is at last coming to its own, and the first link in transportation's chain is at last becoming the greatest."

United States Situation

E. O. Hathaway, district engineer, U. S. bureau of public roads, Minnesota, explained the system of federal aid towards good roads construction in the republic and said that in countries as large as Canada and the United States federal aid laws should be so framed as to develop and increase the effectiveness of the existing highway organizations. Such organizations were in close touch with all local conditions and had a local pride in the success of their departments, and the aid that should be furnished through a federal bureau was not only effective in raising the standard of the department, but was usually welcomed by them. "If it is desirable," said Mr. Hathaway, "in the United States for each state to be supplied with a complete system of highways connecting with adjoining states, and if it is desirable in Canada for each province to be likewise served, does it not follow that the interests of both these great countries will be best served when the federal highway departments of the two countries shall have designed and caused to be constructed, systems in each country so connected as to make possible easy and frequent visits between the two peoples who have so much of social and economic interest in common?"

A. W. Campbell, commissioner of highways, Dominion government, spoke of the federal grant for good road construction, and stated that the expenditure for five years was $20,000,000, to be used in the different provinces for road improvement, the Dominion contributing forty per cent. of the cost of the work. The object of the plan of the federal department, he said, was in the first place to serve the local market and trunk road system, and in the second place to connect with the system of the adjoining provinces so that a complete national system would result. Eight of the nine provinces to date had submitted their general programme plan, involving an improvement of 18,000 miles of road. When the plan was put forward, he said, it was considered that it would be difficult to get the provinces to raise the additional $30,000,000 in order to qualify for the $20,000,000 appropriation, but the plans which had been submitted so far would provide for an expenditure of $73,000,000. That to his mind was exceedingly encouraging. It showed that the people realized to the fullest extent the value of improved roads. It showed that the people had organized for the purpose of classifying the roads according to their improvement.

Standard of Road

The question was often asked, said Mr. Campbell, what standard of road was expected to be built to earn the subsidy? The designing of the road, he replied, was left to the provinces, but the federal department must see that the plans and specifications were designed to form a suitable road to meet the record of traffic, which was furnished with the application for the grant. "Let me tell you that our anxiety is not so much in regard to a very expensive class of surfacing as it is to see that your engineering department is careful in securing a proper location for the road. Secure first a proper location. When that is done then comes the provision of an efficient system of dragging. That is important in every province in Canada. It is something that has been preached for years and years and is one of the points in road construction which cannot be overlooked at any time."

Col. William D. Sohier, Boston, Mass., formerly chairman of the Massachusetts Highway Commission, gave a talk upon sand or gravel and asphaltic oil roads and surfaces, and in a very interesting address told of the difficulties and experiments in his home state.

Col. W. G. McKendrick, Toronto, told of the difficulties he had to contend with when road director of one of the British Armies in France, and said that one thing he had discovered when he was overseas was that the French were the greatest road repairers in the world, bar none. He had seen Canadians and Americans for the last thirty years, and he had been connected with many road battalions of the British in France, but he took his hat off to the French road repairers. All the roads there were of macadam, he said, and they had a system whereby the farmers adjoining the roads looked after their upkeep. One thing they did in repairing that impressed him was that they made their patches level; when a car was going over them, it did not go down into a hole.

* * *

SECOND DAY'S SESSIONS

The value of good roads as an aid to agriculture, as a factor in the development of the country, and as an inducement to tourist traffic were some of the topics—apart from the professional and technical—that were discussed at the two sessions held on Wednesday, June 21.

Herbert Cuthbert, executive secretary of the Pacific North West Tourist Association, gave an illustrated address at the morning session on "Highways and Tourists." He said the money spent by tourists would prove one way of stabilizing the adverse rates of exchange. Illustrating this statement, he declared that when the war began and the pound sterling commenced to depreciate, Sir George Paish, the great financial authority, was asked to give a reason for its decline, and he ascribed, as one reason, the loss to Great Britain of the money left by American tourists in that country.

Urges National Highway

"A Canadian national highway is the best investment the Dominion can possess, and the building of an extensive network of serviceable highways all over Canada is a work of paramount importance, one of the chief reasons being that the farmers benefit considerably," said Mr. Cuthbert. "Where the farmers benefit is in getting their products to the markets more expeditously and at much less cost. These two factors are responsible for lowering the price of commodities to the consumer and increasing the farmers' profits," he added.

Referring to the old days, when it was almost unknown to advocate the building of a highway for tourist travel, Mr. Cuthbert said that America and Canada have not yet quite realized the importance of encouraging tourist travel by means of good roads.

"Our highways have become rivers of gold," he said. "Few people realize the amount of money spent annually by tourists. In the State of Maine, $40,000,000 a year is spent, in Colorada, $40,000,000; in New England, $100,000,000; while in Cuba, the revenue from tourists is second only to the tobacco crop. In Canada, the returns from the tourist crop constitute its fourth principal source of revenue.

"There are 7,500,000 automobiles in the United States, and if only five per cent. of these came to Canada, carrying American tourists, and they spent 30 days in the Dominion, it would mean that $200,000,000 would be left in the country by those visitors," said Mr. Cuthbert, "which amount equals the value of one third of the total exports of Canada," he added.

Comparing the progress of the good roads movement with the rapid improvement of automobiles, the speaker pointed out that the automobile, tractor and truck is a daily necessity to the man of the farm," therefore it is a logical sequence that good roads and highways must be built to meet the change in conditions between the days of the horse-drawn vehicle and the gasoline propelled engine," he added.

As to Freight Rates

A suggestion that the railroads of the Dominion lower the freight rates on road building materials, and so facilitate the increased building of better roads throughout the country was made by A. P. Sandles, secretary of the National Crushed Stone Association, of Columbus, Ohio, during the course of an address. "I believe," he declared, "that in your country, which needs a greater population and more intensive farming, your railroads would prosper if they gave excursion specials to road building material. If the railroad officials had the sufficient vision to see this—and I believe they will get it—the traffic on the railroads will greatly increase as a result."

The speaker emphasized agriculture as one of the chief corner stones of civilization and prosperity, and gave transportation also a very important place. "Canada needs more people," he declared. "You have got a great many good men from the United States and you would get a great many more if you could send a message that you had better roads." He regarded good roads as among the greatest assets of the country, declaring them to be missionaries of greater production, prosperity and happiness. In their road programme he advised his hearers to "go fifty-fifty with the farmer." The farmers of the United States are organizing to get their share of the good roads building programme. "United we stick, divided we're stuck," is their motto, he stated. The farmer, Mr. Sandles said, has hitherto been too stingy to organize to look after his rights. He should do so in order to get his rights with regard to better roads.

Mr. Sandles regarded road making as a profession and advised his hearers that as soon as the public began to realize that fact, the sooner would more roads be built for the money. "Get the best machinery and material," he declared, "and soon that will save time and expense in road building." The best engineering skill is needed in the profession, he emphasized.

"How to improve and maintain earth, clay and sand roads," formed the subject of an address given by A. R. Hirst, state highway engineer, of Wisconsin, U. S. A. "Roads made only of the natural earth of the various localities, with such little adjustments in the composition of their surfaces as may be made by the work of man, will comprise probably for all time in Canada and the United States a very large percentage of the total highway mileage," he asserted.

Mr. Hirst gave his hearers some valuable advice on the treatment of the various soils in the building of roads, dealing with the many problems presented in the different parts of the country.

* * *

Afternoon Session

At the afternoon session of June 2, A. E. Foreman, chief engineer of the public works department of British Columbia, spoke on the "Organization of Provincial Highways' Departments to Obtain and Maintain High Standards of Efficiency." This paper is reprinted elsewhere in this issue.

Situation in Ontario

"Roads as an Aid to Agriculture" was the subject of Hon. F. C. Briggs, minister of public works, Ontario, and before proceeding to deal with it he alluded to the question of outside interference, and said that his experience was that if they had a little less of it and a little less of some of the advice that was given they could make a little more headway. The question that confronted them in Ontario, he stated, was greater agricultural production; would it be attained by immigration; would it be attained by a higher class of machinery; would it be by keeping the boys born on the farms, on the farms and getting them to make their business agriculture? They had come to the conclusion that the best way to increase production was to try and endeavor to get the boy born on the farm to stay on the farm, and, personally, he would not give one industrious farmer's son for two or three of the best immigrants that ever came into the country. They welcomed immigrants, so far as he was concerned he would say of the Anglo-Saxon class, because immigrants in Ontario other than of that class were not very much use to agriculture.

To keep the boys on the farm, what was necessary? Mr. Biggs asked. Probably as much as anything else, education, he would reply. To get the best rural education they in Ontario had come to the conclusion that it was necessary to have good roads. They were endeavoring to work out a system of consolidated schools and continuation schools and to work out the system effectively they must have good roads to transport the scholars to and from those schools. In those schools they hoped to teach the children a typically rural education. They hoped in the continuation schools, in particular, to make the the curriculum one of rural education. They wanted to provide such an education that would equip the children for their life's vocation which they would obtain in the country districts and would not have to be sent to the towns and villages where they were subject to influences that would tend to draw them away from life on the farm. Mr. Biggs pointed out how necessary good roads were to the success of this scheme. They required good roads to bring the children to the schools and in this sense they could see how the question in which the convention was interested had an important bearing upon life on the farm. Discussing the road policy of the government of Ontario, Mr. Biggs said that the impression had got abroad that the farmers were opposed to good roads. The farmers were opposed, he declared, and strongly opposed, to a provincial road right across Ontario that would inevitably be a motor road. But the government hoped by the end of the year to have 2,000 miles of a road system which would connect up the agricultural districts of the province with the populous centres and would relieve the townships of the burden of maintaining roads that bore the heavy traffic.

Mr. Biggs mentioned that the provincial government, in an amendment to the Motor Vehicles act, had provided that motor trucks of only a certain weight could only use the roads to which the government contributed, during the months of March and April so that the highways could be kept from being cut up in the spring season by the heavy traffic. Speaking of the high freight on stones, he could see no reason or common sense in the Dominion government giving a grant towards road construction and then allowing the railways to increase their freight rates. He said this was a matter on which the provincial authorities should get together, and stated that if the rates on stone were increased they in Ontario would be driven out of the market. The minister urged the association to put on an educative campaign to show the people of Canada that good roads were a business proposition and that good roads were a good investment for the country to make.

Macadam Road Building

J. R. Roberts, Montreal, read a paper by Geo. Hogarth, chief engineer of the Ontario Highways Department, on broken stone roads, which, after giving a brief sketch of the evolution from the bush trail, outlined the macadam method of road building with inch and a half stone and screenings without the use of a steam roller. He then outlined the method followed in building a one or two course broken stone road capable of carrying heavy traffic and also alluded to the use of light oils and tars for dust prevention and the use of heavy oils and tars as a carpet coat and for maintenance. The paper will be published in full in a subsequent issue.

* * *

THIRD DAY'S SESSIONS

During the Thursday, June 3, sessions of the convention informative papers were read by experts from Canada and the United States on technical phases of road construction, and following the later sitting the delegates had a demonstration of improved dragging machinery.

Morning Session

Hon. S. J. Latta was the presiding officer at the morning session at which H. S. Carpenter, deputy minister of highways, Saskatchewan, delivered an interesting address on road dragging and maintenance competition. He outlined the best methods of dragging, declaring that the best results were only obtained by constant application of the drag. Constant care and maintenance of the road after the first dragging, the speaker pointed out, was most important. Mr. Carpenter mentioned the many beneficial results of dragging on earth roads, and advised his hearers not to be discouraged if the first attempt was not absolutely successful.

Illustrating the benefits derived from these dragging competitions, Mr. Carpenter stated that 2,518 drags were used in his province last year and 9,844 miles were dragged. The cost was $89,041.

The importance of the maintenance of roads after they had been constructed, was the point most strongly emphasized by W. H. Connell, consulting engineer from Philadelphia, in his address concerning the upkeep of the road, and the theory that a "stitch in time saves nine," which comprised 75 per cent. of the work. "If this rule is followed, the other 25 per cent. will take care of itself," he said.

Mr. Connell strongly advised his hearers not to "rip up old roads and construct new ones of a more permanent type." If the roads are strong enough to support the traffic that passes over them, they should not be turn up and new ones substituted," he declared. "Give them the day to day attention they require, and you can keep gravel and broken stone roads at a cost much less than that of the upkeep of new semi-permanent roads."

Location was very important in road building, the speaker asserted. It would be a waste of money, for instance, to put an asphalt concrete road in a place where there was little heavy traffic.

Speaking of the different types of roads, Mr. Connell refuted the statements that have often been made to the effect that macadam roads will not stand up under heavy traffic. "They will certainly do so," he said, "if they are given the surface treatments they require."

Mr. Connell was especially in favor of the asphalt concrete road. It is the most economical to build and maintain, he declared, and is a splendid type for bearing traffic. An asphalt concrete road must be put on a good foundation, he pointed out. If the road has been travelled, broken stone or gravel foundations give better results than those of concrete.

Concrete roads would be in great demand if they could be kept from cracking, Mr. Connell stated, but cracking is a difficulty that has never been overcome. "Concrete roads with their cracks filled with tar are very unsightly for the city. Asphalt is just as good for wear and more pleasant to the eye." Brick roads, he said, were good, but too expensive. In a service test road of 28 types, constructed in Philadelphia in 1912, only three forms of paving stood the test of heavy motor truck traffic. These were the brick, asphalt concrete and concrete, said Mr. Connell.

"Highway Bridges and Culverts" formed the subject of an address given by M. A. Lyons, chief engineer of the Manitoba Good Roads Board. Mr. Lyons described the various types of bridges, showing the form of structure needed under various conditions. His address was very instructive, and he illustrated the importance of maintaining the care of bridges and culverts along the public highways. The paper will be printed in a subsequent issue.

A. McGillivray, commissioner of highways for Manitoba, who was the presiding officer at the afternoon session, said that in Manitoba they were confronted with the tremendous problem of transfiguring their natural prairies into passable roads. The government of the province through its good roads' organization was co-operating with the municipalities in developing what might be considered their main market roads. They were endeavoring also to lay out this system so as to form a provincial highway system by connecting up the systems in the different municipalities, one with the other, thus evolving a comprehensive provincial system extending from Winnipeg west to the Saskatchewan border and linking up with the roads of that province; and they were also developing their fifty or sixty miles of settled area to the east. They would have to look to the gravel road as the standard of construction for some years at least for the main roads of the province, and the programme they had laid out would keep them engaged for the next five years at least.

Hon. S. J. Latta said he would classify roads in two classes, those for utility and those for pleasure, and he thought this classification would apply to the whole western country. With this definition, the minister proceeded to show the important part good roads played in the development of the west. What, he asked, was the great remedy for the unrest of the world today and the greatest remedy for the high cost of living. It was to direct the legislation towards the home and make conditions in the home so healthy and attractive that a man might be able to work out and solve the problems of the western and eastern country. Stating that transportation facilities were the thing that touched the home nearest, Mr. Latta declared that the first consideration in the west, where distances were great, towards making conditions in the home better was to provide for those homes a good highway that would serve the purposes that were in need at the present time. They had to get the people who came into the country not only to understand their institutions, he said, but into that receptive frame of mind where the other propaganda to make better British citizens out of them might sink well in so that they would love the country because of what the country was doing for their homes.

Mayor T. L. Church, Toronto, called the attention of the convention to the large amounts that had been contributed by federal governments to the railways of Canada compared with the small contributions to the development and construction of highways of the country.

Sees Great Development

"Today Canada stands on the threshold of the greatest highways development in his history, and if the plans now in works are carried to completion it is hard to conceive that this country ever again will have to devise a highways project which will be comparatively so novel, so bold, so extensive, or of such cost," said William Findlay, business manager of the Globe, Toronto, director of the Canadian Good Roads' Association, in discussing "the Value of the Local Association in a Nation Wide Highways Movement." This paper is printed elsewhere in this issue.

Papers were submitted by W. A. McLean, deputy minister of highways of Ontario, on "Traffic Census"; by J. A. Duchastel de Montrouge, Outremont, Que., on "Road Oils and Carpet Coats"; by A. F. Macallum, C.E., commissioner of works, Ottawa, on "Refined Tar in Construction and Maintenance," and by W. P. Near, city engineer St. Catharines, Ont., on "The Cement Concrete Road." The first two of these are published elsewhere in this issue.

The convention has admittedly been one of the most successful in the history of the association not only in point of attendance and the representative character of those attending it, but because of the widely educative effect it will have in driving home to the attention of the people of the Dominion the absolute necessity of improved road construction and the urgency of good roads for the opening up and the development of the country.

Canadian Good Roads Association Discusses Important Matters at Closing Session

At the annual general meeting of the association held in the Royal Alexandra Hotel on the evening of June 3rd, with S. L. Squire, Toronto, retiring president in the chair, the question of the Canadian highway came up in the form of a recommendation of the resolutions committee, that the association urge upon the Dominion government and the provincial governments co-operative action to bring about an early planning of a scheme. After discussion, the matter was referred to the executive committee, the view of many of the meeting being that attention should be mainly directed for years to come to the building of necessary roads in the various provinces for the development of rural districts. Advocates of the proposal urged that making of a plan would not entail any great expenditure and that it would give the provinces some outline to work upon. Hon. S. J. Latta, minister of highways, Saskatchewan, pointed out that the federal government was, in connection with the recent grant, arranging that the highways of the provinces in the west should connect with each other.

The following were elected the officers of the association for the next year:

President, A. E. Foreman, chief of the engineering Department of Public Works, British Columbia; first vice-president, Dr. E. M. Desaulniers, M.L.A., Montreal; second vice-president, Hon. S. J. Latta, minister of highways, Saskatchewan.

Advisory committee: U. H. Dandurand, Montreal; W. A. McLean, Toronto; B. Michaud, Quebec; J. A. Duchastel de Montrouge, Outremont, Que.; S. L. Squire, Toronto; A. F. Macallum, Ottawa.

Directors: J. R. Douglas, president Montreal Auto Club of Canada; L. J. Tarte, Montreal; Hon. F. C. Carrel, Quebec; Mayor Gale, Vancouver, president of the Good Road's League, B. C.; S. R. Henderson, president of the Good Roads Association, Manitoba; Capt. Lucius Allen, president of the Good Roads Association, Ontario; G. Fred Pearson, president of the Good Roads' Association, Nova Scotia; W. Findlay, Toronto; C. R. Wheelock, honorary president Ontario Good Roads Association; Russell T. Kelly, Toronto; H. S. Carpenter, Department of Highways, Saskatchewan; A. M. Rankin, M.L.A., Ontario; T. P. Regan, president New Brunswick Auto Association; H. H. Shaw, president Prince Edward Island Good Roads Association; L. C. Charlesworth, deputy minister of public works, Alberta; and the presidents of the provincial motor leagues and auto associations.

A resolution was passed recommending that the Canada Highways' Act be so amended as to extend aid to all bridges which are part of an approved system of provincial highways, in order that road building may be applied where the need of assistance is greatest.

The association endorsed the view expressed by the council of the Engineering Institue of Canada that the supervision and inspection of highway work of all descriptions should, as far as practicable, be entrusted by municipal and provincial authorities to qualified engineers and young men wth technical qualifications, in order that the experience thereby obtained might be usefully conserved and expanded to the future national advantage in this important public undertaking.

The thanks of the association were accorded to Mr. Squire for his services to the association.

Organization of Provincial Highway Departments to Obtain High Efficiency

Outline of the Plan in Operation in British Columbia to Indicate the Factors Entering Into a Result-Getting Department — Experienced Staff Saves Money — Co-operation Between Staff, Between Municipalities and Between Provinces

By A. E. Foreman, Public Works Engineer of B. C.

WHEN we have a large and expensive work to undertake, whether it be construction work, or manufacturing, there are three primary essentials that must be considered: (1) We must decide upon the most suitable type of machinery for the work in hand; (2) We must procure the most economical power available to operate the machinery; (3) We must place an experienced mechanic in charge and see that all the parts are kept in the best working order and properly oiled so as to reduce the friction to a minimum and enable it to be operated as efficiently as possible.

Similar factors enter into the formation of a provincial highway department: (1) We must decide upon the type of organization that will give the best results; (2) We must procure the most efficient motive power available to energize the organization, and this energy is represented by the personnel of the staff; (3) Having the organization and a competent staff, we must see that every individual unit is in the best and most efficient working order by keeping him systematically in touch with the latest highway engineering practice, and reduce the friction to a minimum by engendering a spirit of co-operation and esprit-de-corps among the members of the staff that will cause the organization to function smoothly and efficiently. And to get results the engineer in charge must not only have experience, tact and executive ability, but he must be an enthusiast and be able to inspire enthusiasm in others as the spirit and activity of the organization depends largely upon his initiative and example.

Divide Province into Engineering Districts

Now dealing first with the type of organization, I believe that experience has proved the best results are obtained by dividing the province into engineering districts, the size of which will depend upon the mileage of roads and nature and extent of work to be done, and by placing a competent and experienced engineer in responsible charge of each district. These engineering districts should be further subdivided into units consisting of one, two or more townships, municipalities or electoral districts, depending upon their size and the method of accounting in the provincial department and each placed in charge of an experienced and practical assistant engineer, or superintendent of construction, who would report and be responsible to the district engineer and to the district engineer only, just as the district engineer in turn should be responsible to the chief engineer and to him only. Each official should have full control of the employment and dismissal of his subordinates. Centralization of responsibility is only possible by centralization of authority and both are necessary for effective organization and satisfactory results. Nothing will disorganize a department more quickly than having the men realize that their appointments are due to outside influences and that their superiors in office cannot dismiss them. Human nature is such that even capable men sometimes take advantage of such a situation, and a little leaven leaveneth the whole lump. The different engineering offices should have adequate technical and clerical assistance, but should not be over-staffed, as this encourages leisurely habits.

Experienced Bridge Inspectors

There should be experienced bridge engineers, or inspectors, to examine regularly and report upon the condition of all bridges, particularly where there are structures which are subjected to traffic conditions for which they are not designed, and they can also co-operate with the district officials in the choice of more suitable sites for bridges which require renewing and which are poorly located.

Where the government has a large amount of costly plant, it is advisable to place it under the charge of a mechanical superintendent. It would be his duty to see that the plant is kept in good working order and not abused, that competent mechanics are employed to operate the different pieces of machinery, and that plant be transferred from one district, when not in use, to another where required, and to dispose of old equipment that is no longer serviceable or economical to operate.

Standard plans and specifications for all classes of work are most essential, also bulletins on the basic principles of road construction and maintenance for the use of the foreman and others. Further, it is necessary to have standard forms for submitting reports so that they will be uniform and comparable.

Importance of Accurate Cost Data

Cost data, where it can be procured accurately and at reasonable expense, is most valuable. On provincial and municipal work, foremen are usually paid the same wage for similar classes of work and there is no monetary inducement to rise above the average. Again, they are too frequently subject to criticism by the public and seldom commended, so that about the only method of arousing their interest in their work is to keep cost data as the work progresses, which will show them what it is costing and be an incentive for them to try to steadily reduce the cost by improved methods. Also the moral effect of having cost records on file in the office for future reference is beneficial.

Again, there should be forms for keeping the cost of loading gravel and rock by hand, by trap and slip scrapers and by mechanical loaders; for hauling road metal with teams, tractors and trucks; and for keeping the cost of operating automobiles.

In British Columbia over 99½ per cent. of the area is unorganized district in which the provincial government collects all the taxes and carries out all of the improvements. We therefore have many requests for roads. The applicant is given this form to fill in. The assistant engineer then examines conditions on the ground, checks the statements made by the applicants and prepares an estimate with a sketch plan on the back and submits it with his recommendations, to the department. All the facts are thus on file in the office and the question can be decided intelligently upon its merits and not necessarily upon the size of petition, or the influence of some of the petitioners.

Success of Department Depends on Staff

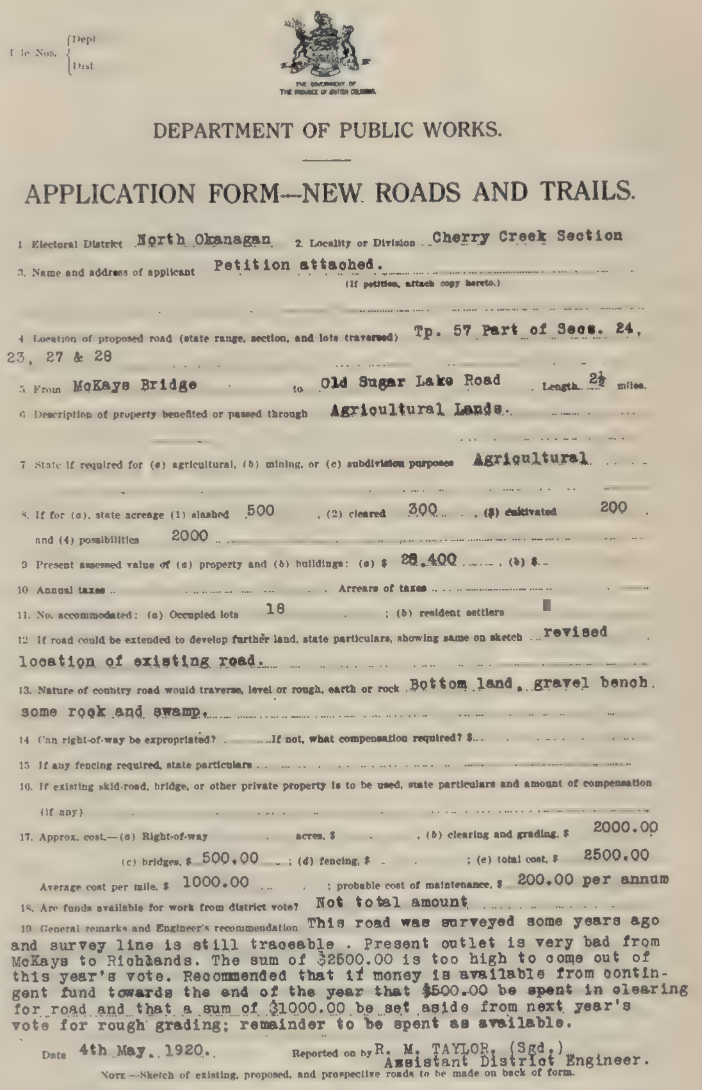
Now with reference to the second factor—the energy of the organization—the staff. The success of the department depends very largely upon the personnel of the staff. A government should endeavor to secure the services of the most competent and experienced engineers available, and I may say that in addition to technical knowledge and experience, tact and sound judgment or good horse sense are important and essential in government service. I believe a successful engineer on government work, and I emphasize the word successful, requires more attributes than are necessary to fill a position of similar responsibility with a private corporation, and to procure men of this calibre a government must be prepared to do two things: 1st, make appointments purely on the basis of qualifications and fitness, and 2nd, pay equitable remuneration for services rendered.

All vacancies in the higher positions should, where possible, be filled by promotion from within the service and such promotions should be based on merit and not on seniority. Failure in this respect will seriously affect the spirit and efficiency of an organization. It will not only discourage good men in the service, but it will deter the desirable type of man from entering the service.

Engineers should be employed who can inspire the confidence of the general public, men of firmness who will report adversely upon a request for work which is not warranted, no matter by whom the request is made, and do so with such fairness, tact and judgment that they will retain the confidence of their chief and of the general public, and when possible the goodwill of the applicant. Such men are none too plentiful, but where a government is spending large sums of public money it should be prepared to pay sufficient salary to obtain their services, and then treat them so that it can retain their services because men of the right calibre will not permit themselves to be used as tools or buffers for ambitious or selfish individuals.

Money Saved by Experienced Staff

Qualified engineers will save their salaries many times over, and I shall give you an illustration. The North Francois Lake Road, which is the main road into the Francois and Otsa Lake Country from the G. T. P. is 15 miles long, runs through a somewhat barren section, but connects a large and rich area to the nearest railroad station. The road as laid out some years ago was located by the local foreman under the supervision of the road superintendent. The grade, alignment and road material were so poor that two years ago it was decided to re-locate all but two miles of the fifteen. The new road is on a better alignment and over more suitable road building material, and it is free from gumbo; has a southerly exposure and is actually some 700 feet shorter than the old one. When the old road was built the cost was not segregated and the original cost cannot be obtained, but today the old road would cost over $60,000 to build, or about $10,000 more than the new one and now has to be abandoned. The traffic over the road can be closely estimated from the records kept on the ferry at Francois Lake, and it is estimated that owing to improved grades, etc., the saving on the tonnage hauled over the road last year would be over $19,000 which capitalized at 6 per cent. would roughly amount to $300,000, and the traffic will increase very rapidly and become very heavy as the settlers are just commencing to go into that district. I could quote many other instances where experienced engineers and a proper organization would have saved in the aggregate hundreds of thousands of dollars, and the importance of engaging competent men cannot be too strongly impressed. This not only applies to the district and assistant engineers, but to local foremen and other employees of the department.



File Nos. {Dept / Dist

THE GOVERNMENT OF THE PROVINCE OF BRITISH COLUMBIA

DEPARTMENT OF PUBLIC WORKS.

APPLICATION FORM—NEW ROADS AND TRAILS.

1 Electoral District North Okanagan 2. Locality or Division Cherry Creek Section

3. Name and address of applicant Petition attached.
(If petition, attach copy hereto.)

4 Location of proposed road (state range, section, and lots traversed) Tp. 57 Part of Secs. 24, 23, 27 & 28

5 From McKays Bridge to Old Sugar Lake Road Length 2½ miles.

6 Description of property benefited or passed through Agricultural Lands.

7 State if required for (a) agricultural, (b) mining, or (c) subdivision purposes Agricultural

8. If for (a), state acreage (1) slashed 500, (2) cleared 300, (3) cultivated 200, and (4) possibilities 2000

9 Present assessed value of (a) property and (b) buildings: (a) $ 28,400, (b) $

10 Annual taxes Arrears of taxes

11. No. accommodated: (a) Occupied lots 18; (b) resident settlers

12 If road could be extended to develop further land, state particulars, showing same on sketch revised location of existing road.

13. Nature of country road would traverse, level or rough, earth or rock Bottom land, gravel bench, some rock and swamp.

14 Can right-of-way be expropriated? If not, what compensation required? $

15 If any fencing required, state particulars

16. If existing skid-road, bridge, or other private property is to be used, state particulars and amount of compensation (if any)

17. Approx. cost.—(a) Right-of-way acres, $, (b) clearing and grading, $ 2000.00
(c) bridges, $ 500.00; (d) fencing, $; (e) total cost, $ 2500.00
Average cost per mile, $ 1000.00; probable cost of maintenance, $ 200.00 per annum

18. Are funds available for work from district vote? Not total amount

19 General remarks and Engineer's recommendation This road was surveyed some years ago and survey line is still traceable. Present outlet is very bad from McKays to Richlands. The sum of $2500.00 is too high to come out of this year's vote. Recommended that if money is available from contingent fund towards the end of the year that $500.00 be spent in clearing for road and that a sum of $1000.00 be set aside from next year's vote for rough grading; remainder to be spent as available.

Date 4th May, 1920. Reported on by R. M. TAYLOR, (Sgd.)
Assistant District Engineer.

Note.—Sketch of existing, proposed, and prospective roads to be made on back of form.

Form of Application for new roads as used in British Columbia

Now thirdly, to keep the organization working smoothly, effectively and without friction, there are two factors that have to be considered: 1st, it is necessary to keep the engineers in touch with the latest engineering practice on highway work by means of literature, etc. 2nd, it is necessary to arouse in them an interest in, and enthusiasm for their work, by creating a comaraderie among the members of the staff and by making each one feel that he is an important unit of an active, progressive and up-to-date organization.

Keep Engineers Posted on Latest Practice

With regard to the former all the engineers should be provided with the best and latest literature on road work. Again, when possible they should be given every opportunity of seeing actual construction work carried on, for example, the laying of concrete roads in which the methods are continually being improved.

The second factor may be accomplished, among other means, by holding annual conferences of the engineering staff. Every member should take an active part in the conference by preparing either a paper, or a discussion on some work which he has been doing. The programme should be drawn up well in advance, so that every engineer may come fully prepared and the very fact of his having to prepare information to place before other experienced engineers will cause him to use every care in securing his data, give him a more thorough grasp of the details and cause him to take greater interest in his work. The results obtained by bringing the men together and giving them the opportunity of exchanging ideas and the inspiration derived from such a meeting will be most beneficial and will add greatly to the efficiency of the men and of the department.

In order that the fullest benefit may be derived from such annual conferences, that the good work initiated may be sustained, special committees should be appointed to deal respectively with road, bridges and ferry matters. Each committee should be under a responsible chairman whose duty it would be to keep in touch with the members thereof, circulate suggestions for improvements in methods of design and carrying out the work, and finally to submit concrete data to the chief engineer for his approval. If properly followed out much splendid work can be accomplished, particularly in providing specifications, plans and forms which are likely to meet general requirements.

Co-operation Is Needed

Co-operation should be the keynote of the department. There should not only be co-operation between the different members of the staff, but co-operation with other departments of the government and with the general public. You can well afford to dispense with the services of even a capable man if he refuses to co-operate. He is a mis-fit and out of gear and has the same effect upon the organization as sand upon the bearings of a machine.

Monthly meetings of the heads of the different branches at headquarters for suggestions for improvements and for constructive criticism are valuable in creating the best departmental organization and upon the efficiency of which so largely depends the successful working of the service inside and outside. Every member of the staff and every employee of the department should be encouraged to make any suggestion that he or she considers would improve the service.

There should be close co-operation between the department and municipalities, and the district and assistant engineers should be encouraged to co-operate with responsible public bodies, such as Boards of Trade, Farmers' Institutes, and Good Roads Associations, but they should not deal with partisan or political associations as such. The latter should communicate with their members or the Minister direct. When you attempt to mix the two ingredients, business and politics, in the department the combination certainly does not give efficiency. There should be a clear line of demarcation between the administrative and the legislative, and to accomplish this harmoniously takes tact spelt with capital letters.

Co-operation Between Provinces

And finally, there should be close co-operation between the highway departments of the different provinces so that they could be of mutual assistance and each benefit by the experience of the others. This could possibly be best attained through the medium of the Canada Highway Branch of the Federal Department of Railways and Canals, which could act as a central bureau for collecting and distributing information And here I would venture the suggestion that a monthly bulletin be inaugurated by the federal authorities in which would be published the more important highway problems common to each province. Such a publication could be an excellent medium for disseminating useful information in addition to keeping the different provinces in touch with what is being done in the other provinces.

In summing up, I believe that if we introduce a proper system of organization and employ only the best qualified men available, keep them efficient and enthusiastic by means of systematic education and co-operation, and discourage outside interference, then I believe the money will be spent wisely and honestly, and when the people are convinced that such is the case, I have no doubt they will furnish unstintingly the large sums of money which are and will be so urgently required for the improvement of our highways.

Notes on Use of Wire Ropes

How to Care for Rope to Secure Maximum Life—Paper Read Before Provincial District Engineers of B.C.

By H. M. Bigwood*

THESE notes are not intended as a treatise on the theory and practice of the manufacture and use of wire ropes, nor will they be replete with formulae and tables, but rather they aim to be a summation of the generally accepted and sane ideas of "How to Use and not Mis-use Wire Rope." They were originally presented in a paper read at the convention of the Provincial District Engineers of British Columbia.

Wire ropes are made in two general types, called respectively "Standard lay" and "Lang's lay," as shown in the sketch No. 1. In the latter type, which has become most generally used since its introduction into England in 1880 the individual wires comprising the strands are laid the same way as the lay of the strand itself in the rope. By this method a longer wearing surface for each wire is exposed than is the case with the older method where the wires were laid the opposite way to the lay of the strand.

In most cases, in wire ropes the number of strands is usually six, and the number of wires either seven, twelve or nineteen to the strand, according to the degree of flexibility necessary for the purpose for which the rope is to be used. As the wires in seven strands are 1 2/3 times greater in diameter than those in strands composed of nineteen wires it will be seen that the former is much less flexible than the latter, but offers less area for corrosion. In seven wire strands the diameter of each wire is 1/9th of the diameter of the rope, and in nineteen wire, 1/15th. The strands of the rope are generally wound round a core of hemp, although for some purposes a wire core is used.

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*Cheif Draftsman, B. C. Department of Public Works.

A type of rope used for standing or running ropes, and suitable for ferries or suspension bridges, is made in sizes consisting of 19, 12, 37 or 27 wires, not laid in strands.

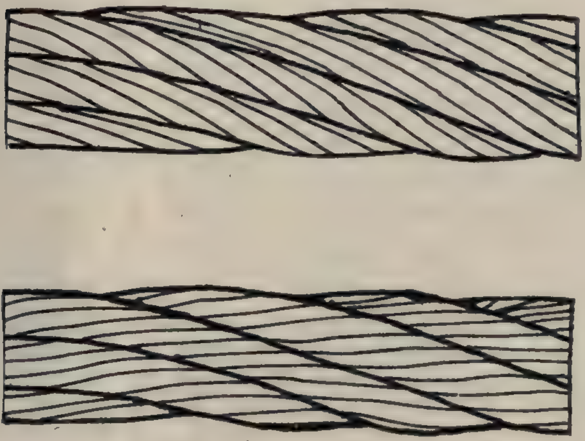


Fig. 1 (upper)—Langs or Albert lay; (lower) standard lay

Materials

Although iron was exclusively used in the manufacture of wire rope for some time, it is now made mostly of crucible cast steel, Swedish iron being used for special purposes, but it is necessary that the steel used be of good quality, as a poor steel is worse than a good iron. Such steel should have a tensile strength of from 130,000 to 190,000 lbs. per sq. in.

For standing ropes as used for ferries or suspension bridges, galvanized rope may be used to advantage. If properly done the process of galvanizing does not materially affect the strength of the material, but it does add a little to the cost, perhaps as much as 15 per cent. now, although the difference in 1916 was about 10 per cent. While the outer coating of zinc will soon wear off under the action of the sheave when the rope is used for ferries, the inner surfaces will be unaffected and protected.

Handling and Unpacking

It is important that new wire should not be allowed to kink, untwist or spin, and great care must be taken to prevent such occurring while uncoiling or erecting.

If the rope is received in a coil it is best to place it on a turntable with battens secured across the top to prevent any of the turns springing off. If on a drum, slip a bar through the centre and raise on to supports. A brake should be applied to check the speed at which the drum revolves. Should the rope arrive in a small coil, roll it along the ground like a wheel, do not try to uncoil it like hemp rope. While uncoiling keep the rope taut, slack rope should not be allowed, nor should it be allowed to lie loose upon the ground.

Lubrication

If the maximum life of the rope is to be obtained the question of lubrication must not be forgotten. Ropes having hemp cores come from the makers with the core fairly saturated with grease, and the aim should be to keep it as nearly as possible in that condition always, to prevent moisture finding its way into the interior of the rope and corroding the wires. When internal corrosion takes place it is extremely difficult to detect at present, although it is hoped that some means to do so will be perfected soon.

All ropes should be greased well immediately after being placed in position and at frequent intervals until all the interstices are filled, then the dressings may be less frequent but regular. Whatever grease is used it must be quite neutral; if it is either acid or alkali it will be detrimental. Grease should remain plastic and should not set hard or shed off in flakes.

Most makers have special compositions which they recommend, but raw linseed oil with lamp black is suitable unless the rope is under water or buried when a coating of vegetable or mineral tar, neutralized by adding freshly slacked lime, in the proportion of one bushel of lime to one barrel of tar, the mixture being well boiled before applying, is recommended. Should this be too thin sawdust may be added to give it more body.

Joint Committee Meeting on Labor Problems

AT a joint meeting of representatives of the International Unions of the Building Trades, and members of the Standard Labor Committee of the Association of Canadian Building and Construction Industries, and also representatives from special branches of the industry, held at Hamilton, May 26th, 1920, the following resolutions were unanimously carried, with the view of eliminating losses through stoppage of work caused by industrial disputes:

1. That a National Joint Conference Board of the building and construction industries of Canada be created, to be composed of five representatives elected or selected by the Association of Canadian Building and Construction Industries, and five members elected or selected by the representatives of the Building Trades International Unions.
2. That this body request the Dominion Government to appoint a representative from the Labor Department to act as chairman and convenor of this National Joint Conference Board,
3. The functions by this National Joint Conference Board shall be educational and advisory, with the purpose in view of its ultimate replacement by a permanent National Industrial Council for the building and construction industries.
4. The National Joint Conference Board shall encourage the organization of both the employers and employees into the groups represented by this National Joint Conference Board, and the establishment of Industrial Councils in the larger centres, such as already exist in Toronto, Hamilton, Ottawa, London and other places.
5. The two parties, members of this National

Joint Conference Board, shall each have the power to change their representative at any time ,and no organization other than those already included shall be admitted to membership except by majority consent of the members of both groups.

6. Affiliated organizations and established Industrial Councils shall be encouraged to refer for settlement to the National Joint Conference Board, such disputes as they are unable to adjust locally before a strike or a lockout occurs.

7. The National Joint Conference Board shall undertake to present to the Government, on behalf of the building and construction industries, such measures as may be requested by both groups, parties to the Board.

8. The National Joint Conference Board shall advise with the organizations affiliating with it on measures which are considered to be of value in improving the building and construction industries such as technical education, apprenticeship, movement of labor, etc.

In regard to a temporary chairman, it was carried that pending the appointment of permanent chairman of the Board, Mr. J. C. Reilly be asked to act as convenor; names of members of Board from both sides to be sent to him at Ottawa.

The following general resolution was also carried: Realizing that the recommendations of this meeting cannot affect the situation immediately, we recommend to employers and employees that they use every means possible to settle their disputes by conference, negotiation and arbitration, in order to avoid further loss by stoppage of work in the building and construction industries in the various centres of the Dominion.

Mr. J. P. Anglin, Montreal, from the employers' group and Mr. Tom Moore, Ottawa, from the employees' group, acted as joint-chairmen of the meeting. Mr. J. C. Reilly, Ottawa, from the employers' group, and Mr. J. F. Marsh, Niagara Falls, from the employees' group, acted as joint secretaries of the meeting.

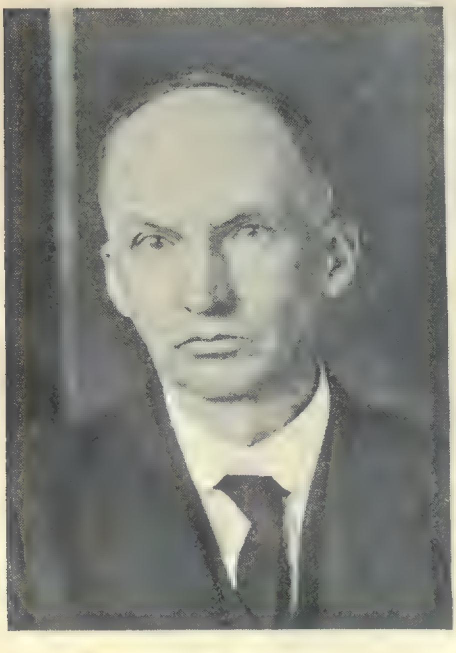
The representatives of Employers' Association in attendance were as follows. J. P. Anglin, Montreal; Jos. M. Pigott, Hamilton; F. W. Dakin, Sherbrooke; H, J. Graham, Ottawa; Mr. Britton, Hamilton; R. Marsan, Stratford.

The representatives of Employees' International Trades Unions in attendance were as follows: Tom Moore, president, Trades and Labor Congress of Canada; E. Ingles, vice-president, International Brotherhood of Electrical Workers; Jos. P. Hunter, 6th vice-president, Brotherhood of Painters and Decorators; John Kennedy, general organizer, International Union of Sheet Metal Workers; Fred Molineaux, general organizer, Brotherhood of Painters and Decorators; Vincent De Falco, general organizer, International Union of Building and Common Laborers; N. Arcand, general organizer, United Brotherhood of Carpenters and Joiners of America; J. F. Marsh, general manager United Brotherhood of Carpenters and Joiners of America; John McLeod, general organizer, Bricklayers' and Masons' Union; L. E. Browning, general organizer, International Association of Bridge Structural and Ornamental Iron Workers; Frank Healy, general organizer, International Union of Portable and Hoisting Engineers.

To represent the employees on the National Joint Conference Board the following were selected: Tom Izzard, bricklayers; Arthur Martel, United Brotherhood of Carpenters; Jno. Kennedy, Sheet Metal Workers; John Bruce, Plumbers and Steamfitters; E. Ingles, Electrical Workers; Jos. P. Hunter, Painters; L. E. Bowring, Ironworkers; Wm. Hamilton, Plasterers.

The following representatives were appointed from the Association of Canadian Building and Construction Industries: K. D. Church, Montreal; H. J. Graham, Ottawa; R. J. Fuller, Toronto; F. W. Dakin, Sherbrooke; George A. Crain, Ottawa.

Three Prominent Delegates at Winnipeg Convention of Canadian Good Roads Association.



Geo. A. Grierson,
Minister of Public Works, Manitoba

S. R. Henderson,
President Manitoba Good Roads Association

W. F. Tallman,
Street Commissioner, Winnipeg

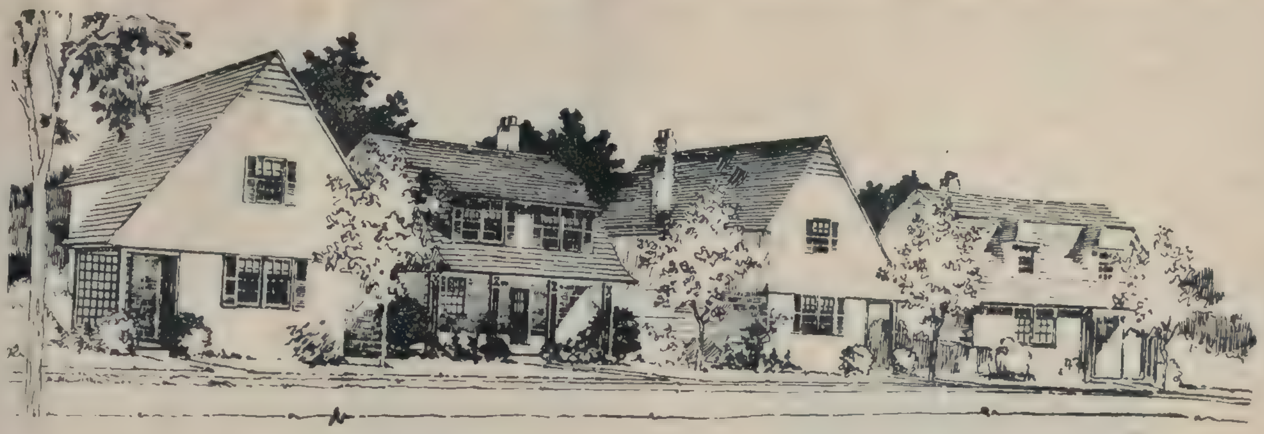


Fig. 1—A group of houses designed for Trenton, Ont., Housing Commission by Wm. Lyon Somerville, Architect, of Toronto

Attractive Houses For Trenton Commission

Wm. Lyon Somerville, Architect of Toronto, Plans Interesting Types, Designed To Be Compact, Yet Roomy and Neat

THE study of the types and designs of houses that are being erected by the different housing commissions throughout Canada affords an interesting insight into the trend of architectural design and economical construction. When judging the fitness of any plant there are many points which it is advisable to consider. First of all there is the general appearance of the finished structure. While the quantity construction of houses in groups does not allow for a very wide variation in design, or for designs that might be termed fussy, yet the houses must be attractive in their simplicity.

Not only must the houses be attractive, but comfort and convenience must not be sacrificed to economy. Thus the architect who succeeds in preparing acceptable plans is of necessity forced to study the best ideas in community construction and exercise a fair amount of originality as well.

The illustration accompanying this article show sketches and floor plans of some of the houses which are now being erected by the housing commission of Trenton, Ont. These were designed by Wm. Lyon Somerville, of Toronto. Those shown are four and five room detached residences. The exterior of the

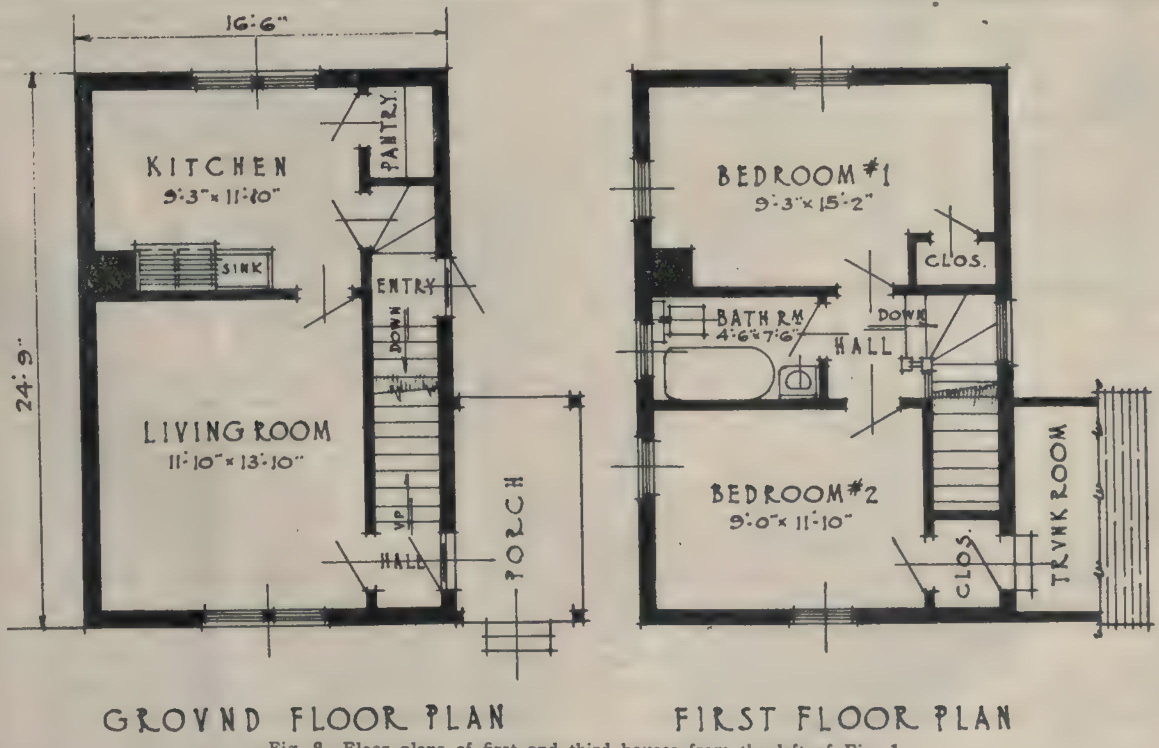


Fig. 2—Floor plans of first and third houses from the left of Fig. 1

houses are varied and the buildings laid out in groups or staggered rows so as to break the monotony and regularity of layout and design so often noticeable in large building schemes.

The four-room residence, which is shown on the right, is a two storey house 16 ft. 6 in. by 24 ft. 9 in. with two good sized rooms on each floor. Entrance is made from the side porch into a very small hall, having a door opening directly into the living room. This room is used as a combination living and dining room.

The grade entrance provides a particularly desirable form of rear entrance. It is convenient to the kitchen, yet gives direct access to the basement. Ashes, vegetables, etc., may be carried up and down without a lot of dirt being tracked through the kitchen. The same idea is embodied in the five roomed house.

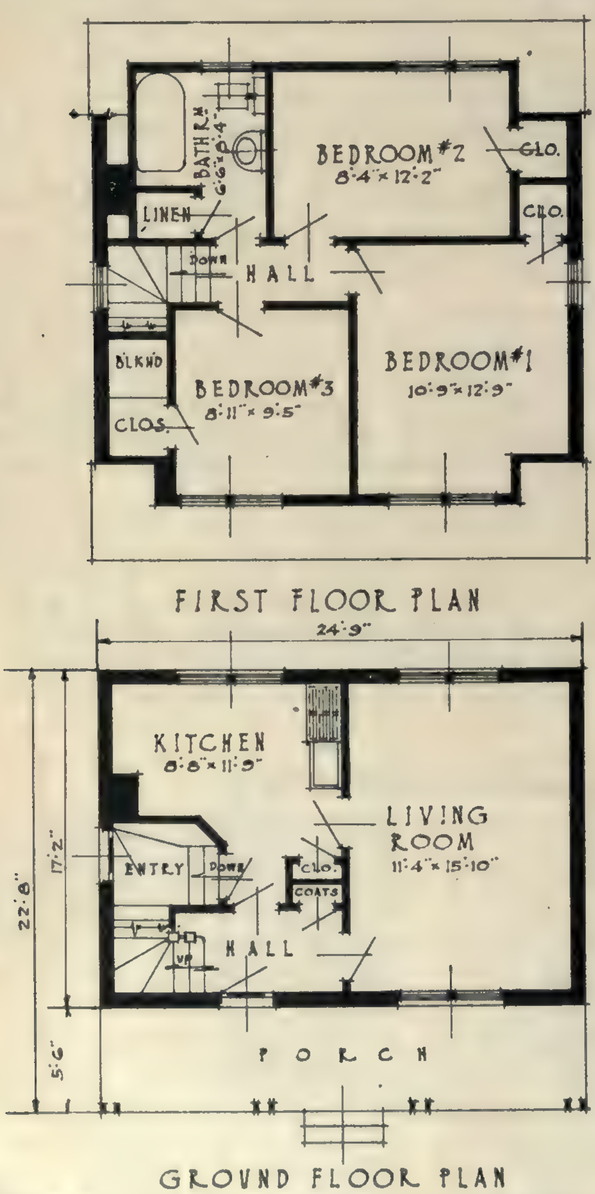


Fig. 3—Plans of second and fourth houses from left of Fig. 1

Light and ventilation are well provided for by the number, size and location of the windows. In the warm weather, the windows in the front and rear may be thrown open, creating a movement of air that will tend to keep the house comfortable. The second floor may be ventilated in the same way. The upper story consists of two bedrooms and bath room. Here again the hall space is reduced to a minimum. The conservation of space effected by reducing halls and eliminating all waste tends for lower construction costs, less house work and better value for the money expended. On the other hand, it will be noticed that closets and pantries are included wherever needed.

The five-roomed house, while the layout is entirely different, will be found to embody the same ideas. It will be noticed that the same effort was made to reduce waste space, save steps and give a maximum of comfort and convenience. The large shady porch adds to the cosy appearance of the house and should prove particularly attractive during the warm summer evenings.

The lines of this house, which is the second from the right, are the long, low, horizontal lines which are so suggestive of cosiness and comfort. One is immediately attracted to a home of this type. The attraction may not be very well defined, but there is usually the thought that it would be nice to own or live in a house like that.

Those who have made a study of home planning and attractive homes have found that the embodiment of a few long, unbroken, horizontal lines give a cosy home-like appearance that cannot be conveyed in any other way. This is well illustrated by the accompanying sketches. If a choice of one of the houses shown here were to be made there is hardly any doubt as to which type the majority would decide on, with little or no hesitation. This is a point that might well be remembered when working out a design for a home.

If this house were to be built where adequate lighting were to be had on the four sides, the insertion of an extra window in the end wall of the living room and another in the kitchen would be a real improvement. It is desirable where possible to have windows in two walls of a kitchen. The average kitchen is not supplied with an over abundance of light, if such a thing is possible, so that while improving the lighting of this important room, an additional window would tend for better ventilation, as a refreshing current of air could be induced by opening both windows, making the kitchen a more comfortable place to work in.

It will be noticed that most of the rooms are odd sizes, such as the living room 11 ft. 4 in. by 15 ft. 10 in. This is partly by design, as in many cases it enables stock lengths of material, such as floor joists, to be used without waste or cutting—another point that tends for lower costs.

It is just this attention to little things, like the size and utility of the rooms, the cutting down of halls and other little used space, the lines and outside appearance of the house that, while adding to the desirability of the finished home, often lowers the cost of construction many hundreds of dollars.

Standardization of Ball Bearings

At the request of the Swiss Standards Association, Baden, Switzerland, for co-operation in the work of standardization of ball bearings, the American Engineering Standards Committee requested the American Society of Mechanical Engineers and the Society of Automotive Engineers to act as joint sponsors for the project. These societies have accepted the responsibility and are now organizing a sectional committee for the work. The sectional committee will be thoroughly representative of all the interests involved and is the body which will be responsible for the detailed formulation of the standards.

Mainly Constructional

East and West—From Coast to Coast

Contracts for road construction in New Brunswick, which have been let to date this year total about $300,000.

Building permits issued last month at Galt, Ont., totalled $138,230 in value or an increase of $37,985 over the total for the corresponding month in 1919.

La Compagnie de Tuyaux de Drainage, Limitee, with head office at L'Islet Station, Que., capital $99,000, to deal in drainage pipe, farm tile, etc.

Building figures from Winnipeg show permits totalling $531,400 issued during the month of May. This brings the year's total to the end of May to $4,199,000.

At a recent meeting of the Manitoba Architects' Association at Winnipeg, a new code of ethics governing the principles of professional practice was adopted.

The Bird-Archer Company, at Cobourg, Ont., have moved into larger quarters and intend manufacturing boiler and machine supplies such as railway valves, high speed cast drills, etc.

Reports from London, Ont., show a total of $253,000 in building permits issued during the month of May, which brings the total for the first five months of the year to $637,080.

Plans for 130 residences are being prepared for the Kipawa Company, at Temiskaming, Que., and it is expected that this number will be increased to 160. Tenders for the construction of these houses will be called in the near future.

Contract will be let in the near future for a four-storey addition to the University of Ottawa buildings, at Ottawa. The new wing will be consructed of reinforced concrete with stone facing and will be fireproof in every respect. The cost is estimated at about $175,000.

The City Council of Hamilton has authorized City Engineer Gray to advertise for an assistant. The city engineer's department has a large program of works to undertake during the present year which will mean an expenditure in the neighborhood of $2,000,000.

During the month of May, the City Architect's Department at Toronto passed plans for work amounting to $3,133,605. The total for the corresponding month last year was $1,455,734. This year's total in building permits issued, up to the end of May was $10,270,358, compared with $4,983,950 for the corresponding period last year.

Personal

Mr. John Cottam, secretary of the Carpenters' Union at Toronto, was elected president of the Building Trades Council recently.

Mr. E. T. Arnoldi, architect, of Toronto, has moved his office from 14 Wellington St. E. to Room 527, Confederation Life Bldg.

Mr. W. A. McLean, Deputy Minister of Highways for the Province of Ontario, was elected honorary president of the Canadian Automobile Association at the election of officers held at the Good Roads Convention in Winnipeg recently.

Mr. Edward P. Merrill has been appointed general manager of the Dominion Iron & Steel Company and Dominion Coal Company, Sydney, N. S. Mr. Merrill will reside in Sydney, and will be in charge of all the operations of the two corporations and their subsidiaries.

Mr. E. L. Cousins, industrial commissioner and general manager of the Harbor Board at Toronto, has returned to that city after an absence of several months in England where he has been endeavoring to interest English firms in the establishment of branch factories in Canada.

Mr. J. A. Tom was presented with a handsome gold pocket knife recently, by the members of the city engineer's department at Guelph, Ont., on the occasion of his resigning the position of assistant to city engineer McArthur. Mr. Tom has accepted a position in the Highways Department at Toronto.

Mayor Chas. F. Gray, of Winnipeg, in whose city the Canadian Good Roads Association met last week

Mr. Frank Foster has been appointed colonization road inspector for the counties of Simcoe, Grey and Bruce, and the townships of Mara and Rama, Ont. Mr. Foster will have supervision of all provincial expenditures on roads, excepting provincial highways, in the above territory. This position was previously occupied by Mr. R. C. Hipwell.

Obituary

Mr. John Bonis, manager of the Thames Stone Quarry Co., of St. Mary's, Ont., died recently as the result of an accident at the quarry. Deceased was in his fifty-first year.

Mr. Albert Chatigny, civil engineer, of Montreal, died recently in his 43rd year. Mr. Chatigny was an employee of the Federal Public Works Department for many years and was one of the engineers engaged on the construction of the channel between Montreal and Quebec.

Trade Incorporations

La Cie de Pavage de Construction de Levis, capital $49,000, head office at Levis, to carry on the business of contractors and builders.

Canadian Hydro-Stone, Limited, with head office at Montreal, capital $500,000, to deal in stone, artificial stone, marble, brick, etc.

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks, Sewerage and Roadways

Dunrea, Man.
By-law authorizing the construction of roads to cost $242,000 for Municipality will be voted on June 26th. Clerk, F. W. Putman, Dunrea. Road grader, heavy engine and traction will be required.

Grand Mere, Que.
City wants prices on 3 motor driven pumps and 1 trench excavator at once. Secy., L. P. Berube.

Halifax, N. S.
J. W. Roland, engineer for Provincial Dept. Public Highways, Parl. Bldgs., Halifax, will receive tenders until June 21st for 4½ miles of broken stone waterbound macadam between Digby and Rossway, N. S.

Laprairie, Que.
Town contemplates the construction of concrete road costing $50,000. Secy.-treas., J. A. Sicotte.

Montmagny, Que.
Municipality is having plans prepared for construction of concrete roads. Secy.-treas., A. Bernatchez.

North Grimsby, Ont.
Township of North Grimsby contemplates the construction of sidewalks. Clerk, T. W. Allan, Grimsby, Ont.

North Sydney, N. S.
Town's plans are being completed for the construction of sewer costing $12,500 and curb and paving costing $25,000. Engineer, W. J. Campbell, North Sydney.

Outremont, Que.
Town contemplates expenditure of $25,000 on construction of sidewalks and $150,000 on construction of pavements.

Town contemplates the expenditure of $12,000 on construction of sewers. Secy.-treas., E. T. Sampson.

Prince Albert, Sask.
City contemplates the expenditure of $75,000 on construction of improvements to waterworks. Clerk, Ernest F. Webb.

Sackville, N. B.
T. Murray, city clerk, will receive tenders for the construction of 4,000 sq. yds. of sidewalk.

Sombra, Ont.
W. A. Scott, clerk for Sombra Township, R. R. No. 3, Sombra, Ont., will receive tenders until June 21st for construction of nine tile drains.

Ste. Anne, Man.
G. E. LaRue, secy.-treas. for Municipality, will receive tenders until June 19th for excavation, laying of and building head wall for pipe culverts. Plans with Highway Commissioner, Winnipeg, and Municipal engineer, Ste. Anne.

St. Bruno de Montarville, Que.
Municipality will call tenders shortly for construction of macadam road. Sec.-treas., Frederic Huet.

St. Catherines, Ont.
Ald. Dakers, chairman, will receive tenders until 5 p.m. June 10th, for construction of sewers. Plans at office of city engineer, W. P. Near.

St. Cyriac, Que.
Municipality plans the construction of waterworks system to cost $25,000. Engineer, M. Demeule.

St. Thomas d'Aquin, Que.
Town contemplates the paving of roads. Engineer, M. Barcelo, 5 Raymond St., St. Hyacinthe.

St. Vital, Man.
E. A. Poulain, secy.-treas. for Municipality, will receive tenders until June 17th for construction of basins and offtake pipes at St. Germain Coulee Culvert. Plans with secy.-treas., Municipal hall.

Toronto, Ont.
City will receive tenders until June 15th for construction of asphalt on six streets, bitulithic on four, brick block on one, macadam on one, concrete curbs on two. Secy. Bd. of Control, Thos. McQueen, City Hall.

W. A. McLean, Deputy Minister for Provincial Dept. Public Works, will receive following tenders: Until June 15th, for 8,000 ft. of 10 in. x ½ in. expansion joint for concrete pavements, plans to be seen at Dept.; until June 25th, for macadam roadway in Edwardsburg Township between Prescott and Village of Johnston, plans to be seen at Dept., and office of resident engineer, Cornwall; until June 25th, for macadam roadway in Pickering Township from Scarboro Town line to Rouge Hill, plans to be seen at Dept., and office of resident engineer, Port Hope; until June 25th, for earth work, rock work, macadam road way and other necessary work on Provincial Highway in Thurlow Township from City of Belleville easterly for a distance of 2 miles, plans to be seen at Dept., and office of resident engineer, Napanee.

Wroxeter, Ont.
D. M. MacTavish, Town clerk, will receive tenders until June 18th for construction of 32,000 sq. ft. of cement sidewalks to cost $5,000. Plans with County engineer, Goderich, Ont.

CONTRACTS AWARDED

Owen Sound, Ont.
Town has placed the contract for concrete work required in paving streets to Curran Clement Co.: Bithulithic work, Warren Bituminous Paving Co. of Ontario, McKinnon Bldg., Toronto.

St. Romuald, Que.
Provincial Dept. Public Highways awarded general contract constructing waterbound bituminous macadam pavement to M. Normand & Normand, L'Islet, Que. Cost, $30,000.

Toronto, Ont.
York Township has awarded contracts for construction of watermains as follows: 12 streets, 10156 ft., Grant Contracting Co., 50 Front E.; 3 streets, 2275 ft., W. E. Taylor, 22 Falcon St.; 4 streets, 4725 ft., G. Thompson, 40 Jarvis St.; 2 streets, 1920 ft., M. H. Murphy Contracting Co., 8 Wychwood Park.

City awarded general contract for repairs to roads in High Park to Asphaltic Concrete Co., Excelsior Life Bldg. Estimated cost, $17,000.

Wiarton, Ont.
Town awarded general contract for construction of reinforced concrete pavement to Messrs. Curran & Briggs. Cost, $16,000.

Railroads, Bridges and Wharves

Bright, Ont.
Geo. Oliver, clerk for Blandford Township, will receive tenders until June 14th for construction of 42 ft. girder span with concrete abutments and floor. Plans at office of clerk and engineers, F. J. Ure & Sons, Woodstock, Ont.

Burrard Inlet, B. C.
W. G. Swan, Harbor Board's engineer, Vancouver, is preparing plans for the construction of dam and causeway across Second Narrows estimated to cost $2,000,000 for Federal and British Columbia Governments.

Cedar Rapids, Que.
Cedar Rapids Mfg. & Power Co., 83 Craig St. W., have applied to Ottawa for permission to construct wing dam. Engineer, R. Wilson, care Company.

Fergus, Ont.
Tenders will be received by West Garafraxa Township Council at the Wellington Hotel, Fergus, until June 15th for construction of two bridges, also concrete floor and wing walls for steel bridge. Plans with Township clerk, Jas. Campbell.

Millwood, Man,
C. W. Thom, secy.-treas. for Rural Municipality of Russell, Man., will receive tenders until noon, June 11th, for erection of bridge to cost $36,000. Plans with Mr. Thom and with Highway Commissioner, Winnipeg.

Portage La Prairie, Man.
D. McCowan, secy.-treas. for Municipality, will receive tenders until noon, June 19th, for construction of 12 reinforced concrete culverts and three concrete bridges. Plans with Mr. McCowan and with Highway Commissioner, Winnipeg.

St. Francois Sud, Orleans Island, Que.
R. C. Desrochers, secy. Dominion Dept. Public Works, will receive tenders until noon June 22nd for construction of repairs to wharf; cost, $50,000. Plans at Dept., Ottawa, at offices of District Engineers, Post Office Bldg., Quebec, Shaughnessy Bldg., Montreal, Post Office, St. Francois D'Orleans, Que.

Sydney Mines, N. S.
C. B. Brown, engineer for C. N. Rlys.,

ESTABLISHED 1886

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The A.C.B.C.I. Offers Every Contractor a Chance To Make His Business Worth While

An appeal for greater unity in the contracting business is contained in an article by J. Clarke Reilly in the last issue of the "Contract Record," under the title of "Future of Contracting Depends on an Organized Industry," in which the writer outlines the work and aims of the Association of Canadian Building and Construction Industries. There is a greater need than ever for unity in the building business. Even the casual observer of present day conditions will detect problems that are upsetting the whole industry and requiring more than individual attention to solve. It is the ability to give co-operative effort to the solution of these problems that makes the A. C. B. C. I. appeal to contractors throughout Canada. These problems are many. There is no need to outline them here for every contractor meets them to a greater or less degree, but in trying to overcome them, many contractors have been forced to give up because of the lack of coherence in the industry. The A. C. B. C I. was, therefore, organized in an effort to unify those engaged in the construction industry in Canada.

The unity which this organization aims to procure will manifest its results in manifold ways, all of which will be of supreme importance to every contractor in the Dominion. The A. C. B. C. I. needs the organized support of every building contractor, sub-contractor and supply man and there is no better way of offering this support than by joining the organization and being a moving spirit in its affairs. These remarks are especially important at this time for a systematic and vigorous campaign is about to be launched and everyone interested will be given an opportunity of showing his interest in the present and future welfare of the industry which lies next his heart. The future of contracting depends on an organized industry. Let us make that future fruitful by staunchly supporting the efforts of those who are seeking to perfect what measure of organization has been already obtained.

Many Works Departments Are Run As No Business Ever Would Be

Organization, as a word, is almost as abused and overused as its sister expression efficiency. Its significance has been to some extent dulled by over-indulgence in its use; yet, like efficiency, organization properly applied gives expression to a very desirable condition. At times organization methods are so very generously applied that, like "too many cooks spoiling the broth," they become so intricate as to defeat the very purpose of their application. In the majority of cases, however, organization is more conspicuous by its absence. This is particularly true in the case of municipal departments and, as far as we are concerned, in this instance, municipal works or engineering departments. Too frequently these departments, the big spending departments of a city's organization, turn out to be the big wasting departments. There is evident a lack of every facility for operating the city's business on a business-like basis; an absence of a coherent and co-operative staff to perform the work and a want of a proper department for looking after the finances.

It is this frequent failure to appreciate the value of organization methods that makes an article, such as that in our last issue, by A. F. Macallum, especially significant. As the Commissioner of Works, of Ottawa, responsible for the new scheme of operation in that city's engineering department, he is especially qualified to write on the topic of "Organization of Municipal Works Department on a Business Like Basis." We will not attempt to review Mr. Macallum's article, but will leave to our readers the suggestion that it contains many remarks that properly adopted would lead to more efficient results.

Perhaps one phase of his article might bear elaboration. It is his remark concerning the prevalent lack of staff in small cities. Mr. Macallum states, in this regard: "Unfortunately the smaller the city the greater the difficulty of securing a sufficient staff and the writer knows of cities of 20,000 population where the city engineer is practically the whole engineering staff. . . . As the cost of an engineering staff for a city is only about 5 per cent. of the cost of work carried out during the year, it is evidently good business to carry such a staff, but unfortunately the average small city council does not recognize this nor does it realize the money lost in carrying out work under incompetent supervision and often without sufficient study of future conditions."

The attention of every small city is called to this statement, for in it is given the reason for many of the ills that beset them. Deeper appreciation on the part of every town and city council of the services rendered by the engineering department would put many such towns substantially on their feet and guide them in the direction where their financial standing would be on a sound basis. Big cities or small, however, there is every need for organization for engineering departments on a business-like basis, for upon the efficiency of that particular branch depends in no small degree the general standing of the municipality.

Contractors Asked to Tender on War Graves Memorial Headstones

SOME action in the matter of headstones for graves of fallen soldiers in France is suggested in the two letters published herewith. It will be noted that tentative tenders for stones are asked for and the attention of Canadian contractors is drawn thereto. A letter from J. C. Reilly, secretary A.C.B.C.I., to the Contract Record, follows:

Editor Contract Record:—

I beg to enclose you a copy of letter received by me from the office of the Chief Architect, Public Works, Canada, in reference to the erection of headstones for fallen soldiers, in France. This may be of interest to your readers.

In reference to war memorials, it may be said that a House Committee has been considering the question of erecting war memorials in France and Belgium on properties which have been purchased or donated. It has been decided to erect eight of these memorials, and preliminary work, in the way of getting roads made to the sites, etc., is, I believe, already under way.

In addition, the headstones for the individual graves, which has been in the hands of the Imperial War Graves Commission, may be taken over by a Canadian section, in so far as Canadian graves are concerned. The stone is of a uniform design, having the regimental badge carved in a 7 in. circle near the top, and below it the name, rank, etc., of the soldier. A cross is carved, with the exception of Jewish soldiers, who are given their own emblem, and there is also room for an appropriate verse or motto, as desired by the relatives.

* * *

The letter from the Chief Architect Department of Public Works, which is referred to in Mr. Reilly's letter, is appended:

J. Clark Reilly,
Secretary, A.C.B.C.I.,
Ottawa, Ont.

Dear Sir,—Yours of the 11th ult. addressed to Lt.-Col. F. Logie Armstrong, Director of Records, Ottawa, has been forwarded by the Department of Militia to this department for attention.

With reference to this matter, I may say that the Imperial War Graves Committee forwarded to this department plans and specifications of headquarters for graves of fallen soldiers in France, and requested if possible that this department obtain some tentative tenders only, together with information respecting the Canadian stone available and forward same to the Commission, in order that they might have something definite before them when considering the advisability of inviting tenders in Canada for these headstones, which they are desirous of doing. Therefore, the specification, as prepared by the Imperial War Graves Commission, has been amended, as far as possible to suit Canadian conditions, and I am forwarding you to-day, under separate cover, a copy of the specifications, drawings and types of badges required, and this department would be pleased to receive tentative tenders only from any firms desiring to submit same. These tentative tenders must be in the hands of this Department or or before the first of July next, in order that the matter can be laid before the Imperial authorities.

It must be distinctly borne in mind that neither this department nor the Imperial authorities are under any obligations to accept the tenders submitted. They are to be considered only in the light of tentative tenders, and treated as such by this Department and the Imperial War Graves Commission.

Yours truly,
R. C. Wright,
Chief Architect.

Holes in Hull of Concrete Ship Readily Repaired With Cement Gum

ONE of the arguments which has been advanced in favor of concrete ship construction is the ease of repair. In proof of this a recent experience with the United States Shipping Board's concrete freighter "Cape Fear" is offered. It is reprinted through the courtesy of Engineering News-Record.

"The "Cape Fear" was built by the Liberty Shipbuilding Co. at Wilmington, N.C. It is of the so-called 3,500-ton class, designed and built by the Concrete Ship Section of the Emergency Fleet Corporation. The ship, while recently in New York harbor, suffered some damage by collision either with a pier or with some other craft, and three holes were punched in her port side. One was just aft of the collision bulkhead, one in the fore hold, and one abreast the boiler room. In New York it was attempted to repair the ship by chipping out the largest hole, approximately 4 ft. square, clear through the shell and pouring concrete between inner and outer forms. It was found, however, that this method of repair would not insure a perfectly tight hull and when the ship came into Newport News it was decided to make a new repair in the yard of the Newport News Shipbuilding & Dry Dock Co., using concrete placed by the cement gun.

The work was done under the direction of Godfrey L. Smith, civil engineer of the company, and the information herewith is from a statement of the repair job made by Mr. Smith.

The first procedure was to cut out all of the concrete that was placed in New York and to clean out the shattered material in the smaller holes which had not been repaired in New York. A form was then put on the inside of the ship at each hole about 3 in.

No. 27.

Canada's Engineers—J. L. Busfield

Mr. J. L. Busfield, who has just been appointed hon. secretary-treasurer of the Montreal branch of the Engineering Institute of Canada, is of English birth. He is a graduate of the Central Technical College, (A.C.G.I.) and a B.Sc. of London University.

Mr. Busfield has been in Canada several years, and is recognized as one of the most promising of the younger generation of engineers. From 1907 to 1912 he was assistant resident engineer, eastern division, Grand Trunk Railway, and in the latter year was appointed assistant engineer and office engineer, Mount Royal Tunnel & Terminating Company, in charge of surveys and alignment, and later of the department of design. From 1915 to 1917 he was with the Georgian Bay Canal Commission, Ottawa, as engineer assistant. Since then he has been principal assistant to Walter J. Francis & Company, consulting engineers, Montreal.

Mr. Busfield is the author of "The Design of Passenger Traffic Terminals," 1918, and "The Mount Royal Tunnel," 1918, both presented before a number of meetings of the branches of the E. I. C. and printed in the transactions of the Institute. He was chairman of the E. I. C. Reception Committee, Montreal branch, 1919-1920, and also chairman of the Reception Committee, annual and professional meeting, 1920

He has been a contributor to the columns of the "Contract Record."

Mr. J. L. Busfield

clear of the inside of the shell and the mortar placed against this form with the cement gun. The extra 3-in. thickness was not thought necessary in the yard but was placed because the captain of the ship very much desired an added thickness shell to insure a perfectly safe patch,

The reinforcement of the shell consisted of two networks of small rods, one near the outside of the shell and one near the inside, and these rods were so closely spaced it was necessary for the workmen to stop guniting twice and to cut the concrete off the reinforcement with trowels in order to get the necessary amount inboard of the reinforcement. The holes were finally filled, however, up to about ½ in. outside the hull, after which they were trimmed down to a fair line by means of shaped steel trowels and the surface rubbed by wooden floats.

Inasmuch as the captain was in a great hurry to get away from the yard, it was then decided to speed up the hardening process by steaming. A canvas screen was dropped over the side of the ship well over the patches and held close against the ship. Live steam was then turned into the space between the canvas and the hull and kept on all night. The following morning the steam was shut off, the canvas screen raised and the surface rubbed down smooth with a carborundum brick and water. The canvas screen was then replaced and steam was left on all of that day and night. The following morning it was evident that the job was entirely satisfactory as there were no cracks anywhere in or around the patch. It was then painted with a special concrete paint and when this was dry a coat of black asphaltum varnish was applied 12 to 15 ft. from the patch and showed no leakage through the hull at any place. The ship left a day after the final patching and so far as is known suffered no further difficulty in its hull.

Lime Association Pamphlets

Recent pamphlets issued by the Lime Association, Washington, D. C., any of which may be had on application, include:

No. 350, Economical Brick Mortar, gives, in concise form, the vital considerations in favor of using lime in brick mortar and is in effect a summary of bulletin No. 300, Ideal Brick Mortar.

No. 351, In the Concrete Chute, summarizes the points in favor of using lime as a means of facilitating the handling and placing of concrete and illustrates this use in a large way on an important structure. It is an introduction to bulletin No. 303.

No. 352, Permanently Dry Basements, shows how lime acts as a water-proofing medium and cites several notable instances of its use.

No. 353, Hydrated Lime in Concrete, gives much useful information regarding the proper use of hydrated lime in connection with building operations and will help in stimulating interest in its use in all classes of concrete work.

Although Mr. Oscar Morin, Deputy Minister of Municipal Affairs for the Province of Quebec, intimated that only $1,000,000 was available for workmen's dwellings in the city of Montreal, at least as a preliminary loan, the Council have decided to apply for a loan of $3,000,000. The sum of $1,145,000 has been allotted to surrounding municipalities.

Sandwashers of the Drifting Sand Filters

Success of This System of Water Filtration Depends on Efficient Working of Continuously Operated Sandwashers—Erosion of Metal Parts is Chief Difficulty and New Types Have Been Evolved to Overcome This Trouble

By William Gore, M. Inst. C.E., M.E.I.C., M. Amer. W. W. Assn.*

THE drifting sand filter system which has been established at Toronto, Ont., and elsewhere, depends for its successful application upon the efficient working of continuously operated sandwashers. These sandwashers have something in common with the ejector sandwashers developed for use with slow sand filters, but differ to the extent that they form part of a closed hydraulic system, and they are required to work with a minimum water pressure with water practically unlimited in quantity. While water pressures of 120 lbs. per square inch are commonly adopted with slow sand ejector washers, these are called upon to work with pressures of 1/100th of that amount.

Operation of Sandwasher

The system with a sandwasher applied to a single unit is illustrated in Fig. 1. The treated raw water enters the filter partly by a standpipe running through the centre of the unit, which passes up through a separator or sandwasher in the bottom and delivers above the sand at the top of the pipe, and also partly through a bye-pass. Within the sandwasher the raw water pipe is formed similarly to the tube of a Venturi water meter and the drifting sand, after being collected and washed in the sand-washer, is inducted into the raw water at the throat of this venturi tube. This sand passes up the standpipe with the raw coagulated water and is delivered with it above the top of the sand already there. This sand forms a volcano-like cone that continuously drifts away and is continually being replaced with the washed sand from the sandwasher, leaving a round topped body of stationary sand below, resting upon the filtered water collecting system. This body of stationary sand does the final filtration. The surface of this body is more than twice the plan area of the unit and is the actual filtering surface, thus economizing the plan area of the filters. The drifting sand passes down all round the boundary of the stationary sand to a system of slots and continues through extractors and thence by a system of pipes to the sandwasher.

At the sandwasher the sand falls to the bottom through a current of raw rater and is thus freed from its impurities. It is picked up by the inductor and carried on to the filter as previously described. The dirty water, impurities or suspended matter pass upward and out at the top of the sandwasher by an outlet suitably controlled. In the external extractors, sand traps are placed of such a form that the sand is kept out of the piping system except when the inductor is in full operation. That is to say, the sand moves only when there is an abundance of running water to carry it forward to the sandwasher and from the sandwasher back again into the filter.

Erosion is Chief Difficulty

The main difficulty so far experienced with this system has been the erosion of the metal parts of the sandwasher where the sand and water are moving at high velocity or with unsteady motion. The erosion has taken place in the throat of the venturi tube, in the sand nozzle which conveys the cleansed sand from the bottom of the washer to the throat, and in the bottom of the washer itself, and a good deal of research work has been carried out in order to get rid of this erosion.

In the earlier washers, side delivery of the sand to the ejector throat was adopted, but more recently the longitudinal or trailing nozzle delivery has been adhered to, except for small units. The adoption of the trailing sand nozzle arose from experiments carried out at Toronto in 1915 with an 8-ft. 7 in. diameter filter unit similar to Fig. 1, and equal in area to one of the units, thirty of which make up a single filter in the Toronto plant.

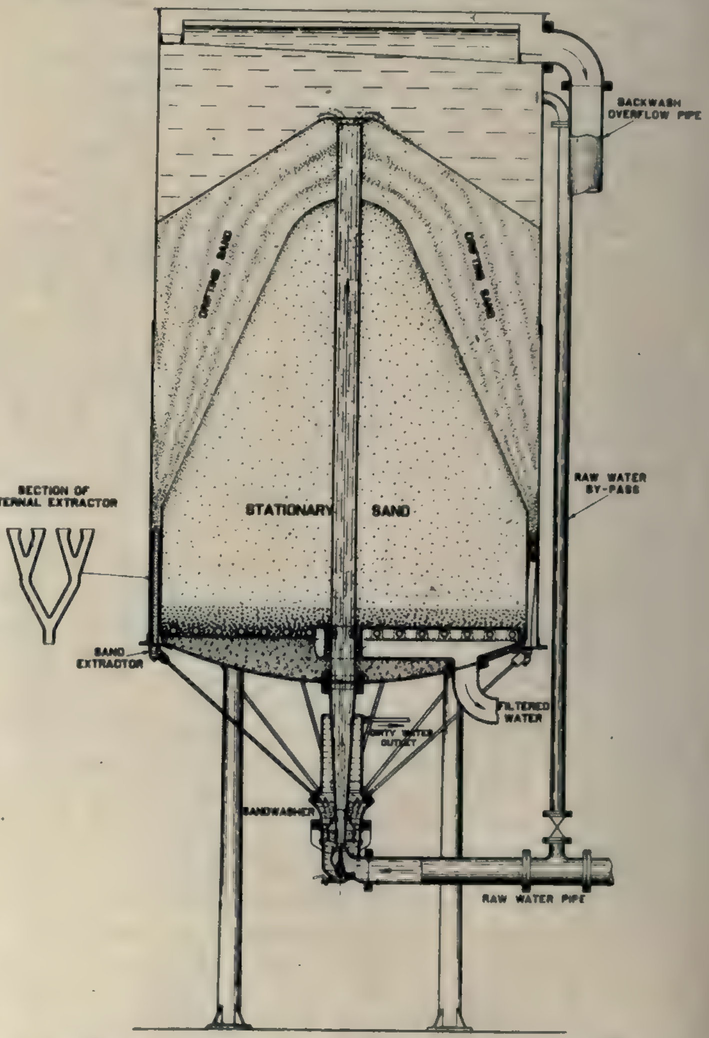

Fig. 1—Section of a drifting sand unit to illustrate its operation and the function of the sand washer

The more important part, that is, the base of the sandwasher, as finally developed by these experiments, is shown in Fig. 2. A run at the full rate during four hundred hours using this sandwasher did not disclose any scour whatever. It was believed that the problem of scour had been satisfactorily solved, and subsequent events have proved this to be the case.

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*Of Gore, Nasmith and Storrie, Consulting Engineers, Toronto.

Loss of Head in Filters

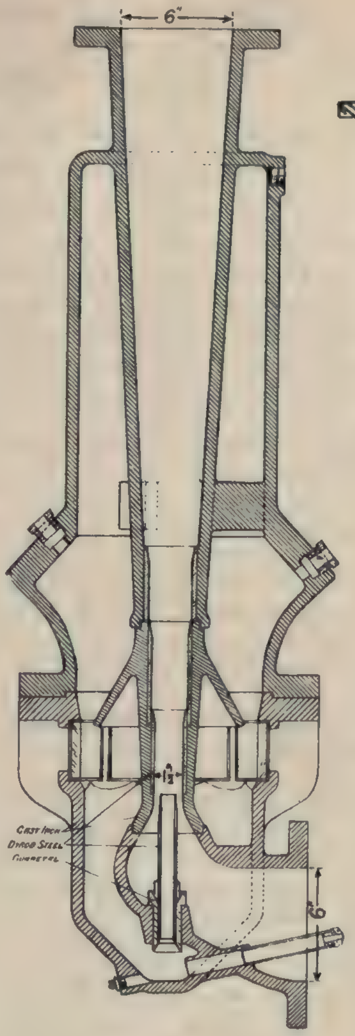
In order to make clear the nature of the work the sandwasher is called upon to do, the following table is given which shows observations of the various losses of head in the typical drifting sand filter. The observations were made upon the test filter during a run of 120 hours, but during working hours only, the water being pumped from a local pond in which there was a considerable amount of suspended matter. The figures apply almost equally well to the Toronto plant, as sand of the same depth and quality is used, with water containing on the whole less suspended matter of a vegetable origin but more of a mineral origin.

TABLE

Duration of run in hours	Rate of filtration in millions of Imperial gallons per acre per day based on plan area	Loss of head in sandwasher in feet	Loss of head in filtering through drifting sand in feet	Loss of head in filtering through stationary sand and under drains in feet	Induction head provided by sandwasher in feet	Difference of head at bottom of drifting sand and in washer in feet. Col. 6—Col. 4	Remarks
0	150	3.0	3.6	2.3	5.1	1.5	1 gr.
5	"	2.6	5.2	1.7	6.1	.9	per gal.
10	"	2.6	5.1	1.9	6.0	.9	of alum
15	"	2.5	3.8	1.8	4.8	1.0	
20	"	2.5	3.3	2.1	4.3	1.0	
25	"	2.5	3.2	2.4	4.1	.9	
30	"	2.4	4.0	2.4	4.7	.7	
35	"	2.4	4.1	2.5	4.8	.6	
40	"	2.5	3.9	2.8	4.7	.8	
45	"	2.5	4.0	2.8	4.8	.8	
50	"	2.5	3.7	2.6	4.3	.6	
55	"	2.6	3.7	2.7	4.4	.7	
60	"	2.4	3.4	2.7	4.2	.8	
65	"	2.5	3.3	2.7	4.0	.7	
70	"	2.4	3.2	2.7	3.8	.6	
75	"	2.4	3.7	2.9	4.3	.6	no co-
80	"	2.3	3.3	2.9	3.9	.6	agulant
85	"	2.3	3.4	3.2	4.1	.7	
90	"	2.5	3.8	3.5	4.6	.8	1 gr.
95	"	2.6	3.5	3.7	4.4	.9	iron sul-
100	"	2.6	4.1	4.0	4.9	.8	phate and
105	"	2.8	4.9	4.2	5.6	.7	½ gr. of
110	"	4.2	5.6	4.6	6.5	.9	lime per
115	"	4.2	5.3	4.5	6.2	.9	gal.
120	"	4.2	5.4	4.8	6.4	1.0	

During most of this test, about two-thirds of the water being filtered was passed through the sandwasher, and the remainder bye-passed to the top of the filter. At the first set of observations, and again when the filter began to clog after 110 hours, an increased proportion of water was sent through the sandwasher. This is shown in column 3 by the increased losses of head.

The drifting sand filter has very definite loss of head characteristics which are brought out by the table and these affect the working of the sandwasher. These characteristics have been studied in considerable detail. It will be noted that under normal working conditions, an induction head (column 6) of less than 5 feet is required in the sandwasher body. During the early hours of a run a maximum slowly develops and fades away again. This is due to the effect of the flat sand surface remaining immediately after a backwash. Another maximum develops towards the end of the run. This appears to be due to a less effective drift of the sand, as clogging takes place in the stationary sand which increases in bulk and area at the expense of the drifting sand, reducing the filtration area of the drifting sand. The greater part of the induction head provided by the sandwasher ejector is taken up by the filtration losses in the drifting sand, (column 4). Thus, if no filtration was in progress, an induction head of one foot or less (column 7) is all that is necessary to cause the sand to circulate. But as the water passing through the sandwasher throat has to be filtered or sent to waste, the practical minimum limit with a normally designed plant is about 50 per cent. of the rated output, and the simplest working conditions are found at about 66 per cent. of the rated output. The loss of head in the stationary sand (column 5) has very little effect on the operation of the sandwasher. This loss follows the normal law of filtration loss of head. That is to say, there are slow increased losses of head at the beginning of a run which increase as the run proceeds.



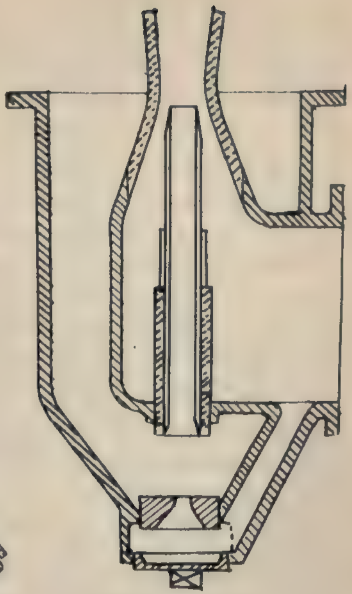


Fig 2

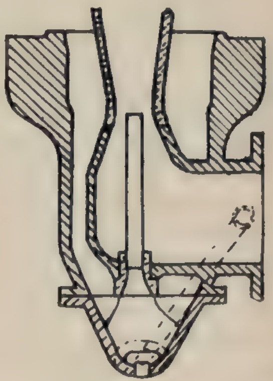


Fig. 4

Fig 2—Base of sandwasher of test filter. Fig. 3 (left), section of sandwasher developed for Toronto filters. Fig. 4. New sandwasher base for Toronto filters

In summing up the experience with the test filter sandwasher, two points appeared to require further consideration. One was that the irrigation water jet at the bottom of the washer would foul with sand occasionally after shutting down the filter, and the other that the sand nozzle, (13½ inches in length), was rather long and absorbed by friction more head than was thought necessary; and in the design for the actual sandwasher bases for the Toronto plant, shown in Fig. 3, both of these defects were removed.

Throat of Venturi Tube Lined to Offset Scour

Some experience with Toronto sandwashers disclosed a local erosion in the throat at the point marked x on the vertical plane of the section and opposite the main water inlet which reduced the efficiency of the ejector, and it was found necessary to line the throat of the venturi tube. This has been conveniently done with carbonized W.I. pipe in steps as shown. The smallest diameter tube required renewal about every four months and the intermediate one yearly. The sand nozzles last a full year and the scour at the bottom of the washer has had to be repaired once in three years. These experiences being so different from what might have been anticipated from the experiments with the test filter, it was decided to study the matter in further detail.

A sandwasher base from one of the filters was connected up to an independent source of water supply with the water jet and sand nozzle exposed, and it was found that the velocity of the water at the jet varied from point to point in a given plane normal to the direction of motion, it being greatest at the point of maximum scour and least at a point diametrically opposite. At the point of highest velocity there was the greatest suction with the result that the sand coming out of the nozzle was drawn toward that point. There was also at this point considerable turbulence owing to it being found on the line of coalescence of the two streams of water formed by the sand nozzle acting as an obstruction in the fairway of the water. By comparing the two designs, the cause of the difference in the experiences is apparent. In the test filter design the water passing to the throat does so from a comparatively quiescent large body of water, and forms a comparatively steady jet, while in the adopted design the spaces provided were restricted, and the water passed at moderate velocities past the sand nozzle and up around the bend, hugging its periphery, producing the disturbances noted.

New Sandwasher Bases Require Little Attention

It was decided to introduce at two points in one of the Toronto filters, sandwasher bases corresponding in the form of the water passages closely to those of the test filter. The actual design is shown in Fig. 4. A considerable improvement in the bottom of the sandwasher base was introduced and the sand nozzles were formed so as to be drawn out from below. These have been in operation over twelve months and show very little scour, and none at the bottom of the washer, and they run without attention.

As a matter of performance, each of these sandwashers during the twelve months they have been in operation have properly washed and cleaned about five thousand tons of sand, withdrawing it from, and delivering it again to, a height of about 18 feet, with practically no attention, and the throats and sand nozzles are still in good condition. This is considered highly satisfactory, and shows that these sandwashers are highly efficient machines. The work of installing new sandwasher bases and throats throughout the whole plant is now in progress.

At Rockland, Ont., a sandwasher is adopted in which the raw water supply pipe as it enters the sandwasher is widened out to reduce the velocity of approach with the same idea of maintaining the steady jet at the throat of the sandwasher.

A. C. B. C. I. Starts Membership Campaign

At Recent Meeting of Executive, Arrangements were Completed for a Thorough Coast to Coast Canvass

PLANS for a vigorous membership campaign were arranged at a meeting of the executive of the Association of Canadian Building and Construction Industries, held in Toronto on the afternoon of Tuesday, June 8th. It was decided at this meeting that the whole of Canada, from coast to coast, should be thoroughly canvassed with the view to enlarging the membership of the association and fostering its work. This development program will be carried out systematically and intensively, the complete arrangements, financial and otherwise, having been completed by the executive. It is hoped that before long the results of the campaign will be evident and that every eligible contractor and supply man will be enrolled in the A. C. B. C. I. Simultaneously with the inauguration of this campaign there is being formed an advisory council comprising men prominent in public and industrial life in Canada. By these two measures, the A. C. B. C. I. is showing its determination to place the contracting industry in Canada on a higher plane. It is a big work to accomplish, the success of which will be to the advantage of every contractor individually and the industry as a whole. The co-operation of all in the construction industry is needed and in making the plans for a membership campaign, the executive is urging all contractors in Canada to render the greatest possible assistance in elevating the status of the business. By taking out a membership in the A. C. B. C. I., each contractor or supply man can contribute something to the welfare of the industry in which he is most interested.

Those present at the meeting of the executive were: Messrs. J. P. Anglin, J. B. Carswell, J. Phinnemore, and J. Clark Reilly.

Contracts for 2500 miles of rural and toll telephones in Alberta have just been let. This is the second lot of telephone contracts that have been let this year, the first being for some 5,000 miles of long distance circuits, the work on which is now about half completed. Tenders will be called for the third lot between June 15th and the first of July when the construction will be on rural lines.

The Broken Stone Road is a Valuable Type

For Ordinary Travel, It May Be Built at Comparatively Small Expense — Ease of Maintenance is an Advantage

By Geo. Hogarth, O.L.S., M.E.I.C.*

HIGHWAY development in Canada may be said to begin with the trail or bush road and, depending on the lightness or heaviness of traffic, to advance by well-defined steps to the state of earth road, then a gravel road, then a macadam road and, finally, if finances permit and traffic is heavy, the road receives a bituminous or concrete pavement. For all time to come many miles of our highways will remain earth roads. Some roads being more important and leading to railway stations or market centres will have gravel applied to them as traffic increases and the need for a better road arises, and later, when that traffic becomes heavy and approximates 200 to 500 vehicles per day, the need of a stronger road crust will be evident and a macadam surface of broken stone will be laid. Such a stone roadway will carry economically with ordinary maintenance a traffic up to 1,000 or 1,500 vehicles per day.

Broken stone roads for ordinary travel may be built at comparatively small expense where rock is situated close to the highway. The installation of a crushing outfit at any convenient point will provide in one season sufficient stone to surface a number of miles of roadway, and by crushing the stone to all pass a 1½ inch ring, no rolling will be necessary. In operating such an outfit and building a road, the usual procedure is to pass all stone over a screen after crushing and draw into one bin all the dust and chips up to ½ inch. The rest of the stone passes into a second bin and is drawn away and spread on the road. The road grade should first be properly drained and slightly rounded up in the centre and a layer of the crushed stone from ten to fifteen feet wide and three to five or six inches thick is placed. After the first layer of stone is in position and spread a coating of the screenings and dust is distributed on top of the first layer, and the road is left for traffic to consolidate. In this manner a broken stone road for light traffic may be constructed with the minimum of expenditure, and if limestone is used and care exercised in levelling and spreading the stone a satisfactory result will be obtained.

Stone Roads for Heavy Traffic

Where it is desired to properly construct a one or two course broken stone road for heavy traffic more care is required in all the road-building operations. The preparation of the subgrade must be given close attention and the drainage of the roadway properly provided for. Side ditches with good outlets will be required and the bottom of the side ditch should be at least two feet below the crown of the roadway. Many soils are found to be wet and soft and tile drainage under or alongside the stoned portion must be provided to draw away the water and permit the soil to dry out and harden. If the country is rolling it will be found that tile drainage is absolutely necessary to dry out wet spots on hills, particularly at points from 50 to 200 feet below the crest of hills, as it is at such points the ground water tends to come to the surface, and by creating springs, will cause the road to soften and break. By properly ditching and tiling the earth subgrade it is possible to create, at small expense, a hard dry surface upon which to place the foundation course of broken stone. Drainage is essential to roads and the money so spent is returned because the well-drained road costs less to maintain and lasts longer than one that is poorly drained.

The earth subgrade, after being properly drained and graded, is thoroughly rolled, and the base course of stone is uniformly spread upon it. This base course may be ten to twenty feet in width and from four to seven inches in depth and composed of coarse, stoney gravel, field boulders, broken stone or telford. The quality or hardness of the stone used in the foundation course is not important, as the wearing effect of wheels does not come on the base course, so that any stone is usually satisfactory. When the base course is in place, a roller should be used to consolidate the stones and render them firm for the top course. The spaces between the stones in the base course may be filled by screenings or coarse gravel and the whole watered and rolled.

On top of the base course a depth of broken stone, about four inches in depth, is placed. This top layer is composed of stones about two inches in size, and as it is the wearing course of the road the quality, toughness and uniformity of the stone is important. Any good limestone may be used for the wearing course, but the hardness of the stones should be uniform, as otherwise the quick wearing of the softer stones will create a rough road in a short time. The top course is thoroughly rolled and is then watered and screenings applied and spread over the stones to fill the voids. Brooms are used to sweep the screenings into all spaces and the surface is watered, broomed and rolled until hard and unyielding under the roller. A light coat of screenings is applied and the road left for a few days to dry out before being opened to traffic.

Maintenance Measures

The broken stone road is readily constructed, easily maintained and readily repaired. It is a pleasant road to drive over and, with proper maintenance, is economical. It may be found that after being in use for years a broken stone road has small holes and ruts over its entire length. One method of preventing the road becoming rough is to establish a system of maintenance by patrolmen shortly after the road is built. Under ordinary circumstances one man with a one-horse cart and a small outfit of tools will be able to patrol and keep in repair from three to five miles of road, and he will not need to be continuously employed to do that. The repairs consist in filling the holes and ruts with large stones, covering the stone with screenings and tamping the patch tightly into place with a pounder. An experienced man will patch a road so that the road is smooth and the patches cannot be detected a few days after the work is done. After being under heavy traffic for some time a broken stone road may become rough and pitted, so that resurfacing is necessary. This work is undertaken by first scarifying and loosening the old surface, after which the stones may be levelled off and a new course applied, rolled in and finished the same as when building a new road. It is this ease of repair which makes the broken stone road one of the most economical to maintain and keep in good surface.

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*Chief Engineer, Ontario Department of Public Highways, before 7th Canadian Good Roads Congress.

Dust Prevention

During the summer months a broken stone may become dry and dusty. To prevent this condition arising it will be necessary to apply oil or light tar to the surface at the rate of about one-third gallon per square yard, and then spread sand, screenings or pea gravel lightly over the material, the oil or tar to blot up any surplus and stop the material sticking to the wheels of vehicles. An application of a dust preventive in the early spring and a second in mid or late summer will render the road dustless during the months of heavy summer traffic.

Broken stone roads are rounded or crowned slightly in order to shed water. The amount of rise given the centre of the road should be as little as possible consistent with proper drainage. A slope of ¼ to ½ inch per foot will usually be found sufficient and will give on a road 20 feet wide a crown 2½ to 5 inches higher at the centre than at the sides. A rise of from 3 to 3½ inches will be found very satisfactory on such a width of road.

On steep grades broken stone roads will be found to give good foothold for horses. In such situations the maintenance cost will be high, because of the material washing away. Broken stone roads have, however, been successfully maintained on grades of from 5 per cent. to 12 per cent.

Broken stone roads have several advantages among which may be mentioned that they do not require rigid or expensive inspection and they can be laid in all but freezing weather. If well built it retains its shape and does not distort or wave or creep, and is an easy riding road for team or motor traffic. The disadvantages of broken stone roads are that if subjected to much traffic in the spring they tend to break up and ravel, while heavy automobile traffic tends to sweep away the dust particles between the large stones, leaving a rough surface.

The ravelling of broken stone roads under traffic may be prevented by the application of a hot coat of bitumen. This coat is applied after carefully sweeping the surface and a quantity of from one-quarter to three-quarters of a gallon per square yard is used. Such material may be applied by means of a pressure distributor. It is then covered with a layer of ¾ inch stone, and rolled.

Gypsum Board Survives Severe Fire Test

Its Fire Resisting Properties Are Successfully Demonstrated — Excessive Heat Produced No Distortion

GYPSUM was successfully shown to be an excellent fire-resisting material at a test recently conducted behind No. 1 fire station at Toronto. The demonstration was to determine the action under fire of a material known as gypsum board, which is composed of pure gypsum reinforced on each side with a sheet of felt paper. This product is prepared in 32 by 36 by ⅜ in. sheets and is nailed directly to studding in partition or wall construction. At the test in question, by which the efficacy of this material was investigated, two panels 12 x 16 ft., representing wall sections, were erected and subjected to the direct action of fire for a period of 35 minutes. The panels comprised 2 by 4 in. studding covered with gypsum board on both sides, the face of one panel being sheeted with clap board to simulate outside wall construction and the face of the other panel coated with cement mortar, superimposed on a scratch coat of gypsum plaster with chicken wire reinforcing between. The gypsum board on the backs of the panels was plastered with one coat of ordinary hard wall plaster. In fig. 1, the panels are illustrated before their subjection to fire.

After 35 minutes exposure to the action of fire, an excellent demonstration was given of the fire retarding properties of the gypsum board. The clap boarding, of course, was quickly consumed and the cement mortar coat was entirely chipped off, but the gypsum board on the face of the panels was entirely undamaged. The remarkable feature of the demonstration, and one indicating the excellent qualities of the gyp-

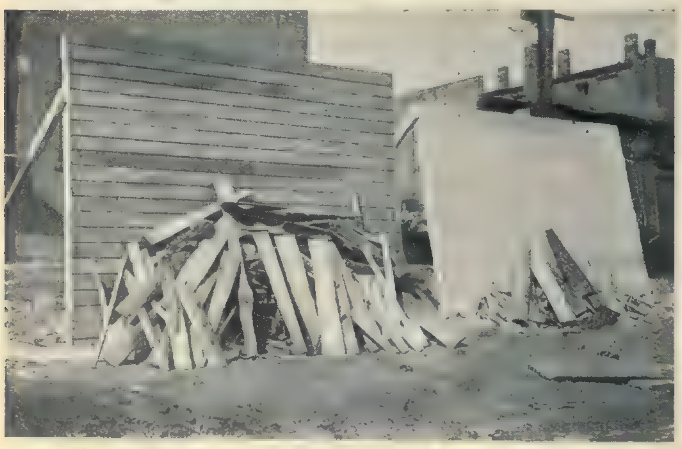

Fig. 1—The two panels of gypsum board ready for the test

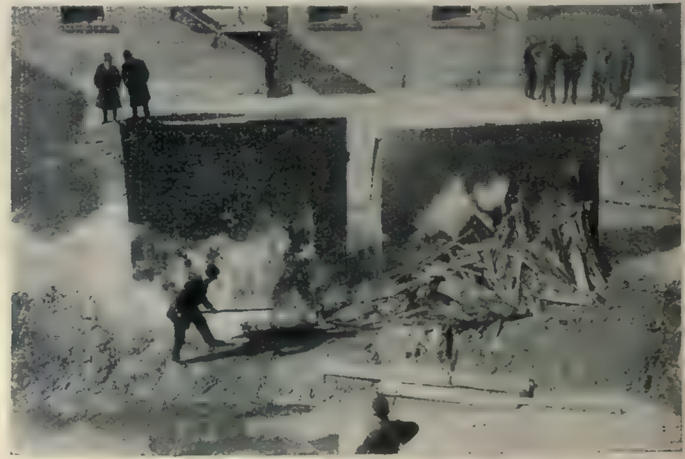

Fig. 2—While the clapboarding and plaster coats were affected, the gypsum board remained unimpaired

sum board, was the fact that during any part of the test it was possible to place the bare hand on the rear of the panels without detecting the slightest increase in temperature. It was this property that seemed to be of most interest to the many observers who were present. It was considered quite remarkable that although only four inches of air space and two thicknesses of gypsum board separated the fire from the back of the panels, no heat transmission could be detected. The cement stucco on the face of one of the panels was, of course, damaged due to the expansion caused by the extreme heat and to the fact that it was still green when the test was being conducted. The gypsum board, however, was not distorted in any way by expansion.

By liberal application of the hose, the effect of sudden cooling was investigated, but the panels remained unimpaired. No cracking or scaling developed, thus indicating that the board has remarkable power of resistance. To the "Contract Record", Fire Chief Russell stated, "Gypsum board is a remarkable medium for resisting the action of fire. I was extremely pleased with the tests which demonstrated that this material is not only durable but fire retardant. I must say, of course, that it is affected somewhat by moisture, but as a fireproof material it is excellent." Mr. Sykes, of the City Architect's Department, stated his viewpoint in somewhat similar terms, pointing out that for interior partitions, it has unusually excellent properties.

Fig. 3—Even sudden cooling failed to produce cracks

The gypsum board used in these tests was manufactured by the Ontario Gypsum Co., Paris, Ont.

Saskatchewan municipalities have not taken full advantage of the Dominion Government's housing scheme because any additional borrowing on this account would cut down the borrowing powers of these municipalities materially. A conference of board of trade officials from various parts of the province was held last month in Regina to discuss the situation and the following resolution was passed and submitted to the Saskatchewan government. "That we approach the government of Saskatchewan with a view to having it advance to the municipalities under the Housing Scheme Act, moneys on the general credit of the municipalities to be relieved by the securities taken by such municipalities upon their being turned over to the government as collateral to such loan and to the extent of such securities."

Factors Entering into a Consideration of the Housing Problem

Report of Committee on Resolutions Before National Conference on Concrete House Construction

CANADA and the United States are now confronted with an unprecedented housing famine, so universally recognized as to need no emphasis. This originated in governmental allocation of labor, materials and capital to war needs, and has been continued and accentuated by the diversion of labor, materials and capital to the production of non-essentials. To such an extent is this true that the public demand for these non-essentials, and even for luxuries, is raising the cost of housing, while the people are bidding against each other for the houses which exist. The effect of this housing shortage is not merely to inflict hardships on the people, but to excite to higher pitch those feelings of discontent so widespread in the country since the war.

The main factors with which we have to deal are more numerous than is the general belief; they involve among others, land. materials, labor, finance, transportation, design, legislation and building ordinances. Clearly, relief can come only through the construction of more houses of the right type. All building is for a profit in some form. Unless profit can be reasonably assured in residence construction the building of homes will be limited to prospective owners who are but a small fraction of the population of large communities. Houses must be provided for the great mass who can only afford to rent or to buy on long-term instalments.

If, as will be generally conceded, after food supply, houses are the most fundamental need of the people, housing supply should take precedence over all other use to which capital can be put, and we are justified in urging that all possible steps be taken to make investment of private capital in house construction more attractive than any other form of investment. Investment can be encouraged but cannot be forced.

Land and Materials

We may say in general that price and availability of land at present are such as not to be a serious obstacle. Unimproved land is held at low figures because of the difficulty which its owners find in putting it to profitable use. This condition in reality should act as a stimulus to building.

The wildest latitude in the use of approved materials should be encouraged. Especially should this be emphasized for the purpose of relieving transportation congestion and the lowering of building costs. Because numerous sources of supply can generally be drawn upon, concrete is one of the most readily procurable building materials.

There is now a famine of houses. There is also a heavy demand for building materials for other and less important uses. Materials needed for home construction should be regarded as in an essential class, and as such be given preferred consideration in manufacture and distribution. Manufacturing of such materials should give priority in shipment when intended for this purpose, as opposed to other uses less essential to the public welfare. These recommendations should be brought to the attention of manufacturers of building materials and manufacturers of all other essential appointments entering into the completion of homes.

Labor

Full recognition should be given to the fact that the laborer's cost of subsistence has greatly increased. Every available means should be employed to call the attention of labor to the fact it injures itself by arbitrarily retarding construction. These nullify the benefits derived from high wages to the extent of the advance in rents. Labor's attention should be directed to the fact that opposition to improved methods and processes of construction will postpone, if not defeat, efforts to quickly increase the supply of houses, while the co-operation of labor in every unselfish, patriotic way will help labor as well as the whole people.

The urgent necessity of labor assuming its full responsibility in the production of satisfactory houses by the use of efficient and economical methods should be apparent to all. Co-operation on the part of labor should be evidenced by its willingness to arbitrate all questions, the non-settlement of which tends to retard construction and thus to increase its cost.

Labor should appreciate the fact that it cannot expect the support of public sentiment in any attempt to condemn the use of certain materials and methods of construction, unless such methods and materials adversely affect the health and safety of workers or the public.

Finance

One of the chief problems encountered is lack of funds to finance some building. It is desirable in the public interest that the funds now tied up in first mortgages held by the building and loan associations be made available for dwelling house construction. Much money hitherto invested in first mortgages on dwelling houses is being diverted to non-taxable investment channels. It is desirable that exemption from income tax be granted to such investments.

Recognizing the fact that the building and loan associations of America are an important factor in financing home building and home ownership, and that these institutions confine their activities to teaching thrift and financing home ownership, we urge all organizations and individuals interested in promoting the construction of homes to affiliate and co-operate with building and loan associations in their localities and to assist in forming such associations where they do not now exist.

As the most difficult financial obstacle to the construction of homes is that of filling the gap between the amount obtainable on first mortgages and the amount the purchaser is able to invest, we commend the work of community housing corporations and employers of labor who are using their own funds or credit to relieve the urgency of the present housing shortage.

Design

To secure results that will satisfactorily meet present housing needs, safety and economy in the construction of homes must be recognized as of paramount importance. These are attainable only through the use of the most adaptable materials applied by the best talent in design and construction.

Transportation

Adequate building operations are dependent upon uninterrupted transportation at reasonable freight rates. The transportation systems of the United States and Canada have been and are insufficient to transport all traffic offered. The movement of building materials has been restricted and impeded by insufficient cars, and by preference accorded to other commodities in car supply, resulting in the serious curtailment of building operations.

Materials used in building operations, such as cement, brick, stone, lumber, steel, etc., are shipped in carloads. The majority of them are transported for relatively short distances only, and utilize the full cubical or weight-carrying capacity of cars. Concrete construction forms an integral part of all building—often the entire structure—and requires a minimum of transportation. The average rail haul of a car of cement in normal times is approximately 175 miles, and the loading is to the carrying capacity of the car, while such building materials as sand, gravel, stone, etc., are usually secured at locations so near the job that they require relatively little transportation; hence concrete construction requires less transportation per unit of weight or measurement than other forms of construction.

In the case of building construction, the transportation rate plays a very important part. The ratio of freight paid to total cost is higher with reference to building materials than to commodities in general; for instance, on sand, the rate of freight is often many times the value of the sand at the pit, while on a silk shirt the cost of transportation across the continent is so small a per cent. of the selling price as to be negligible. Therefore, to increase the freight charges on building materials one cent per hundred pounds is to enhance the cost of the structure greatly. This is permanently reflected in the rental. An increase of even $5 per one hundred pounds in the rate on silk shirts would be barely noticeable to the purchaser. Any further advance in freight rates on building material will retard building operations.

Legislation and Building Codes

It is urged that building officials give their support and influence in securing economies in constructtion by standardization of requirements for building materials and supplies of all kinds and the removal of undue restrictions applying to the erection of homes. It is particularly urged that legislative bodies enact more reasonable laws governing the use of concrete in the erection of houses, so that the construction of better and more nearly fireproof and permanent structures may be encouraged as contrasted with an existing tendency to accept less desirable construction, while the users of better materials are frequently penalized by excessive requirements. The thickness of walls, as frequently required by present building laws, is greater than is essential to the safety of the structure. The requirements for the use of concrete in dwellings are fixed by regulations which govern the construction of warehouses. Light walls and floors, possible with concrete and ample for the needs of the ordinary house, are prohibited by these laws. Nor does the value of the concrete, from the standpoint of fire protection, receive the recognition it deserves. If these descriminations were removed there would be made available for more extensive use a material, to a large extent of local origin and employing local labor in its fabrication, for the relief of the housing situation.

Justifiable Types and Costs of Bridges

From Point of View of Economy, When Should Bridge be Built?—What Type of Structure Should be Selected?

By M. A. Lyons*

THE most difficult things to decide about a bridge are, whether or not the bridge should be built, and the proper size of opening. From the view point of economy when should a bridge be built? It is evident that the bridge must effect some real saving to economically justify its construction. This effected saving may be one of distance over which loads must be hauled or persons travel, or it may be a saving effected by an increase in the size of the load which may be hauled due to its construction. As it costs about 35 cents per team mile to haul a load it is seen that the money in cents which can be spent on a bridge in order to save distance is 35 times the team mile saved. For example, if the construction of a bridge will save a travel of five miles to five persons who have 40 loads to send to market each year the total justifiable yearly expenditure would be $350.00 On a wooden bridge this would justify the expenditure of about $2,500 or on a permanent bridge of about $4,500. Likewise when the cost of auto traffic is 15 cents per mile a saving of two miles for an average traffic of four cars per day for 200 days per year would effect a yearly saving of $240, or taking the two suppositions together, an annual saving of $590 which would justify the expenditure of $8,000 on a bridge lasting thirty years.

The amount of justifiable expenditure due to a saving effected by an increase in the weight of the load which can be hauled by the construction of the bridge will also vary as the traffic, and when the amount of the traffic is known the economical expenditure can be ascertained.

This however, is only the economic side, and is perhaps not as important as the social or sentimental side which cannot be estimated in concrete units but must remain a matter of judgment or sentiment. The economic consideration is, however, generally the one on which the engineer must base his decision. Sometimes, however, neither economy nor sentiment is the deciding factor but vested rights or orders of courts may compel the construction of a bridge.

Determination of Waterway

The determination of the area of waterway required is quite often a different matter. Various methods of determining this approximately are available. First, where there is an existing structure, by an examination of how this structure has fulfilled its duty; second, by evidence of men who are acquainted with water conditions at the proposed site; third, by an examination of water levels as shown on the surrounding objects; fourth, by an examination of run-off data supplied by the Hydrometric Survey; fifth, by an examination of rainfall data supplied by the Meteorological Service; sixth, by means of formula; seventh and emphatic, by means of one or several of these methods and common sense.

Where there are existing structures the problem is somewhat simplified but not solved. On small creeks there is a tendency to under-estimate rather than over-estimate the size of waterway required, especially if some years have elapsed since a season of heavy run off. Where only temporary structures are being placed this is perhaps not so important, but where the structure is to be a permanent one, care must be taken that the area is sufficient to provide for the greatest run off which may take place. Too much dependence cannot then be placed on the size of the existing structure, but information must be obtained as to the area required under greatest flood conditions. If a structure has successfully passed all water for a considerable number of years including year of excessive run off, we know that it is at least large enough, and information must be obtained as to actual flood conditions in order to determine whether or not the waterway area can be reduced, should this reduction prove economical. On the other hand, on large streams the high water mark has a tendency to move up a little beyond where the other man saw it. If definite marks of flood water elevation recorded by men living in the vicinity at the time of flood can be obtained, these are generally to be depended upon. From cross section measurements of the valley and known flood elevations, the area of the required waterway can be estimated.

The Value of Run Off Data

The water marks on surrounding objects are not a very accurate method of determining flood water elevations. If a few years have elapsed since the season of heavy run off, these marks may be entirely obliterated and any marks found be quite misleading. They are really only one indication to assist in determining the area required. The most valuable and dependable records of all are those supplied by the hydrographic survey, where these go back a sufficient number of years. Unfortunately, these records cover comparatively few streams and on most streams cover only recent years. They do, however, form a valuable guide in determining the runoff on streams other than the ones which are covered by their records. While not numerous, the hydrometric stations are fairly well distributed and the runoff of typical streams in various parts of the country has been recorded. Knowing the maximum runoff, the drainage area, the type of country constituting the drainage basin, it is a simple matter to arrive at an estimate of the discharge of a stream of similar drainage basin, which estimate will be of assistance in determining the proper waterway. As an example, from the discharge record of the Valley River for 1913 (a year of heavy runoff in this portion of the country) the maximum discharge is found to be 3500 c.f.s. The discharge divided by the mean velocity of 4 ft. per sec. gives the area of the required waterway and this divided by the drainage area of 1028 sq. miles gives as the waterway required an area of .85 sq. ft. per sq. mile of drainage basin, for this particular stream. Knowing the drainage area of a similar stream and multiplying this area in square miles by 0.85, would give some idea of the area of waterway required for this stream. The Valley River rises in the southerly slopes of the Duck Mountains and runs fairly rapidly to Lake Dauphin and the discharge fluctuates rapidly. From a similar record of the Rat River, which flows through a comparatively level country, the discharge is found to be 1030 c.f.s., mean velocity 1.63 cu. ft. per second and drainage area 650 sq. miles, requiring a waterway of 0.98 sq. ft. per square mile of drainage area.

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*Chief engineer, Good Roads Board, Manitoba, before 7th Canadian Good Roads Congress.

Common Sense in Selecting Opening

In applying this method, it is important to know that the records available on any river cover greatest flood periods and an accurate knowledge of the drainage basins is necessary. The drainage area of the larger streams can be ascertained from present maps with sufficient accuracy, but sufficient topographic information is not always available to apply this to smaller streams. The Topographical Surveys' Branch are, however, undertaking to secure information which will be very valuable for future studies along this line. A study of the records of the meteorological services will also guide the judgment in selecting a proper area of waterway. Reasoning from one drainage basin where total maximum precipitation and maximum percentage of runoff are known to a similar drainage basin for which meteorological records can be obtained, a comparative estimate of the maximum runoff of this basin can be made. There are also a number of formulaes which can be applied under certain conditions to drainage areas which will also be a guide to the judgment. With the exception of the testimony of dependable observances of flood conditions, and the actual record of the hydrometric surveys, the various methods mentioned serve only as guides for the judgment in selecting a proper waterway and all must be applied with common sense.

Selecting the Type of Structure

In selecting the type of structure, three factors will influence this choice: viz., economy, service and appearance, and of these the first two will generally, but not always rightly, be the deciding factors. It is impossible to estimate the value of the aesthetic in design, and as this value cannot be expressed in concrete symbols, it is frequently not understood and consequently beauty of appearance is not given full value in deciding on the type of structure. It is a question how much additional money should be spent in order to achieve a pleasing appearance. One dollar alone has a very anaemic appearance in these days, but where a few thousand of them are considered they have a very aesthetic appearance, more so to some than to others; but it is a fact that the cost of a bridge is soon forgotten while an unsightly bridge cannot be forgotten, for it remains as a constant unpleasant jar on the senses.

In selecting the economical type of bridge, first cost, upkeep and value of non-interruption of traffic must be considered. The timber structure is, in about every case, the cheapest in first cost but in the long run does not generally prove to be as cheap as steel or concrete. A wooden pile bridge, if suitable for the site, is no doubt the cheapest bridge in direct cost. For example, a 50 ft. pile bridge will cost to-day about $1,500. Allowing 6 per cent. interest, a yearly payment of $270 would be required to keep this bridge in condition, made up as follows: Flooring to be removed every three years, first cost $270, yearly payment for 3 years $101; stringers to be removed every 6 years, first cost $270, yearly payment $55; remainder of bridge to last 12 years, first cost $960, yearly payment $114; total yearly cost $270. Indirect costs, such as delay to traffic during repairs, loss of traffic through neglect of repairs, liability to accident or fire, may run the total cost far beyond the direct costs. At best the pile bridge is very unsightly and only to be considered where first costs are of prime importance, as they sometimes are.

Comparison of First and Yearly Costs

In many cases, stream conditions are such that it is not permissible to have piles in the stream bed, and a clear opening of long span is required. The type of structure may then be a choice between a wooden span, a steel span or a concrete span. Unless the wooden span is to be placed on piles which in many cases is not feasible, the cost of the substructure for the three types will be about the same, so that it will only be necessary to compare the relative costs of the superstructure. Again selecting a 50 ft. span for comparison and allowing the following conditions, wooden flooring to be removed every 3 years, wooden stringers every 6 years, painting wood and steel every 4 years and life of concrete and steel over 30 years, life of wooden truss 15 years, we have the following relative costs:—

FIRST COSTS

Wooden Truss

12,400 f.b.m. timbers at $100 per M.	$1,240
3,000 lbs. steel at 15c per lb.	450
Painting	250
	$1,940

Steel Bridge

12.6 tons steel at $220	$2,772
4,600 ft. timber at $80	368
	$3,140

Concrete Bow String

68 cu. yds. concrete at 35c per cu. yd.	$2,380
11600 lbs. steel at 10c per lb.	1,160
1850 sq. ft. mesh at 20c per sq. ft.	370
1000 lbs. structural steel (bearings, etc.) 20c lb.	200
Crosby clips and handrail	200
	$4,310

YEARLY COSTS

Wooden Truss

Flooring 2800 f.b.m. at $80 cost $224; yearly payment based on 3 year life	$ 84
Stringers, 3200 f.b.m. at $80; cost $256; yearly payment based on 6 year life	54
Remainder of bridge $1210; yearly payment based on 15 year life	125
Yearly cost of painting every 4 years	72
Total yearly cost	$335

Steel Truss

Timber, 4670 ft. at $80; cost $374; yearly payment based on 3 year life	$140
Yearly payment on steel truss for 30 years (cost $2772).	201
Yearly cost of painting every 4 years	36
Total	$377

Concrete Bridge

Yearly payment on concrete bridge for 30 years (cost $4310)	$311

It thus appears that the concrete superstructure for spans of this length at least is cheaper than either wood or steel. It must also be noted in the case of steel and concrete bridges that at the end of 30 years the bridge is paid for and the yearly payments cease (except for the repairs on the steel bridge) while in the case of the wooden bridge the yearly payments still go on.

Many Factors Affecting Cost

For bridges of any size, it is impossible to make any general statement that one class of bridge is cheaper than another, as every bridge is a problem in itself and the foregoing is given as an example of a method of obtaining relative costs. The question of the nature of the foundations, cross section of the stream bed, condition of stream flow, waterway required, availability of materials, relative cost of materials, relative costs and availability of labor, relative cost of substructure to the superstructure, ice conditions, economical and suitable length of span must be taken into account when deciding which is the economical bridge. Wooden bridges are confined chiefly to two types, the pile trestle and the Howe truss. For steel bridges of clear span of 30 ft. or under, simple stringer spans are cheapest, from 30 ft. to about 45 or 50 ft. plate girders; from 50 ft. to 80 or 90 ft., low or pony trusses; 400 or 500 ft., trusses with subdivided panels; beyond this, cantilever or suspension bridges, with steel arches coming in any place in the list.

Every concrete bridge is a study in itself. In Manitoba, there has been constructed or underway, slab and girder bridges up to 30 ft. span, through girders up to 50 ft. span, barrel arches up to 100 ft. span, open spandrel arches up to 60 ft. span, through arch or rainbow type up to 90 ft. span and bow strings up to 90 ft. These are, however, only given as an example of different types of concrete bridges.

In appearance, concrete bridges can be made to surpass any other class of bridge. They can be poured into any form and beauty must lie in their lines and not in any ornamentation. To my mind there is another strong argument for the use of concrete and it is that the materials used in making of concrete are almost without limit. The time when our timber will be exhausted can be foreseen. Iron ore is limited and can never be replaced.

Loading Allowances

All bridges should be designed by competent engineers. The design of ordinary steel bridges is so standard that there is very little difficulty about getting a suitable bridge after it has been decided what loads it may be called upon to carry. The decision of the proper loading is one which will require careful study but in the end must remain largely a matter of judgment. The tendency up to the present has been towards an increase in the weight of loads carried on highways. Many bridges have been discarded recently owing to the fact that they were not heavy enough for present traffic. In Western Canada the heaviest likely load appears to be a large tractor. In Manitoba we design our floor system for a tractor load of 18 tons plus 30 per cent. impact and our trusses for this tractor for a load of 100 lbs. per sq. ft. whichever produces the greater stress. The tendency appears toward lighter tractors rather than heavy ones. Before these bridges are worn out, however, some of them may be called upon to support heavy truck loads, but it is doubtful if these will ever exceed 18 tons.

The design of the foundation is most important. The bearing power of different soils varies so greatly and similar soils vary so greatly under different conditions, that careful examination must be made of the soil in order to properly design a foundation. It is a strange fact that there is probably less data on the variable factors in the behaviour of soils than on most other materials of construction and, therefore, the assumption made in the design of foundations is largely a matter of experience and judgment.

The design of reinforced concrete structures is not so standard as the design of steel bridges, and structures should not be considered which have not been designed by a competent and experienced engineer.

Inspection is Important

Proper construction is just as essential as proper design. Great care must be taken in the selection of the material. For steel bridges, the material rolled by steel mills is so nearly standard that for ordinary bridges no hesitation need be had in accepting structural shapes. But in order to eliminate poor field riveting, enlarged rivet holes made by drifting in erection, and other faults which may produce stresses for which no provision has been made, all shop work should be carefully inspected before the material is shipped to the job.

In reinforced concrete work the inspection must needs be more rigid. The cement should be subjected to standard tests before it can be used. The making of cement is a delicate process and any one of several factors entering into its manufacture may cause a variation in the product. Especial care should be given in the selection of the aggregates; these must be well graded and absolutely clean. It is probable that more failures occur through the use of improper aggregates than from any other cause. The water used must be clean and just the right proportion used. Professor Abrams has shown that the proportion of water to cement is one of the big factors affecting the strength of concrete. The amount of water used should be just enough to make a workable mix, and any greater proportion of water rapidly decreases the strength of the concrete. There is only a certain amount of water required to cause the setting of the cement and it is quite evident that any amount beyond this, when it has dried out, leaves voids in the concrete.

The inspection of the steel is also very important, not only as to quality but to determine that the bending is done according to plans. It is quite a common idea that any sort of steel will do for concrete reinforcing but such is not the case. This steel is designed to take its share of the stress fully as much as the steel in a steel bridge. The steel must occupy the exact space it is designed for, otherwise it is entirely of no use in the structure. For this reason, the bends shown in the plans must be strictly adhered to.

It is also important to have experienced contractors for concrete work and just as important as inspection of the material is inspection of construction. This inspector must be a man who knows his business better than the contractor and who has sufficient tact and judgment to get the work properly carried out without undue hardships to the contractor. It is a mistaken idea that any person will do for an inspector.

The form work is very important in concrete work as it must be strongly buildt to withstand the pressure which will come up on it and also must have a smooth surface, for every flaw in the forming shows up in the finished structure. Careful ramming of the concrete is necessary in order to make a dense concrete, prevent voids forming next to the forms and cause a close bond between the concrete and steel.

Culvert Design

Coming to the small but important culverts, there are in general four types in common use, first, the wooden culvert; second, steel or iron; third, concrete pipes; and fourth, concrete culverts cast in place. The wooden culvert is undoubtedly the cheapest but the objection to this is that it is often out of commission or unsafe. In point of cost, the concrete pipe culverts come next. These, however, must be placed where no water will freeze in or around them and they must have a good solid bed. Considerably saving has been effected in Manitoba by the use of concrete pipe and the results have been quite satisfactory.

Corrugated steel or iron pipes have been used extensively where lack of suitable materials or labor prevents the making of concrete pipes; also these can be laid in places where it would not be suitable to lay concrete pipes. We have also used cast in place semicircular reinforced concrete culverts with good success. These cost about the same as the corrugated iron pipes. We seldom use pipe culverts of over 30 in. or 36 in. in diameter. Above that we advocate reinforced concrete box culverts.

In these days of specializing, transportation is second in value only to production, and only within the last few years have most people realized the vital part that the road plays in our transportation system. At a time of shortage in the prime necessities of life, when the world teeters between enough and starvation, our market highway system is of its greatest importance. The bridge is the important link in this system. Nominally the bridge serves to carry water under a road or traffic over the stream. Actually its possibilities are unlimited. Its existence may mean a supply of food to a starving being on another continent, or the difference between life and death to a sick one or the difference between hope and despair to a toiler. Its appearance may be the cause of pleasant fancies or it may be the cause of a feeling of repulsion. Let us, therefore, in our bridge work do what we can to cause pleasant thoughts and create pleasant memories, and in this work, as in all our highway work, build well.

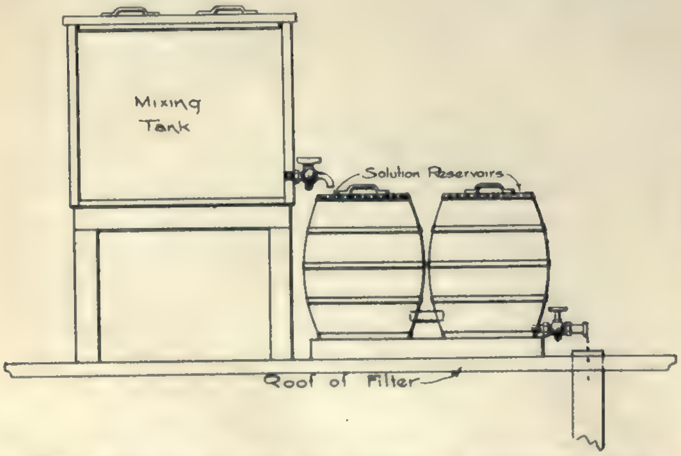
Sewage Purification at Mowatt Sanitarium

20,000 Gallons per Day Disinfected With Chloride of Lime—Equipment is Simple but Results are Effective

By A. Langlois, B.A.Sc., C.E.

IN the February 25, 1920, issue of the "Contract Record" an article by the author described the sewage plant of the Mowatt Sanitorium and its construction. This article indicates the methods of disinfecting and purifying the sewage and sewage effluent. The plant has been in operation since December, 1919.

The quantity of sewage flowing through the plant is approximately 20,000 gallons per day. Chloride of lime is used as disinfectant and the chlorination equipment consists of a square wooden tank with a capacity of 60 gallons. It is used for mixing. The solution from this tank goes into two 10-gallon kegs arranged as shown on the accompanying drawing. The idea of having two receptacles for the solution is to ensure an absolutely clear liquid flowing through the regulation valves, as there is always a certain amount of undissolved matter coming from the mixing tank. These solids will settle in the upper barrel leaving a clear solution only into the outer keg, ensuring thereby a safe and regular flow of the solution through the valves, which are made of special acid proof metal.



Wooden tank and two kegs form equipment for disinfecting sewage

The cost of treating the effluent is estimated at $1.56 per day average, and includes the entire upkeep of the plant, cleaning, heating in the winter, chloride of lime, etc.

I wish to say here that the sprinkling filter would probably work perfectly without any artificial heat, which would mean a considerable saving item in the cost of the upkeep of the plant. This will be tried next winter. There is more latent heat in the filter than we would believe, enough I think to prevent the sewage from freezing.

Since the month of January several bacteriological analyses have been made of the sewage effluent, the results of which are shown in the following table:

	Bacteria per C.C.			B. Coli		
Date	Raw sewage	Septic Effl. without Chlorination	Septic Effl. after Chlorination	Sewage c.c.	Before Chlorination c.c.	After Chlorination c.c.
Feb. 2		9,000				
Feb. 5		58,500				
Feb. 5		28,500				
Feb. 5		24,000				
Feb. 12	800,000	25,000	500	0.0001	0.001	Free
Feb. 23	1,920,000		220			Free
Feb. 24	160,000		30	0.0001		absent in 0.1c.c.
Feb. 28	220,000		20	0.0001		Free
Mar. 5		4,000				
Mar. 6			2			Free

Chemical Analysis Showing the Effect of the Filtering Stone

		Parts per million	
		Septic tank—	Filter effluent
March 5	Suspended matter	4.1	1.6
	Oxygen consumed	About the same in both samples	
April 8	Suspended matter	67	12
	Oxygen consumed	23.2	10.8

This last test shows that filtration has removed about 80 per cent. of the suspended matter, and 53.5 per cent. of the organic matter. The system is working admirably in every respect. The sewage in the sedimentation tank has been, for about three months, entirely covered with a heavy scum, of over one foot in thickness. The sewage effluent from the filter as well as from the septic tank is absolutely free from any odor. Some two weeks ago the sludge chamber was emptied for the first time. This part of the system also worked to expectations, the matter coming out of it being very black and of very light consistency, free from lumps or undissolved solids.

The Deterioration of Structures in Sea Water

Institution of Civil Engineers Has Investigated the Behavior of Timber, Metal and Concrete Structures

THE Institution of Civil Engineers (British) has just issued the first report of a special committee, with Sir William Matthews, K.C.M.G., as chairman, formed to investigate the deterioration of structures of timber, metal and concrete in sea water.

This report is the result of investigations carried out by this special committee of the institution, with financial assistance from the Department of Scientific and Industrial Research, and both the institution and the department have every reason to be satisfied with the extremely valuable information which the Committee has collected, and with the able manner in which the report has been prepared. The report forms a volume of three hundred pages in royal octavo, together with several useful plans, maps, and photographs, and must be regarded as a valuable work of reference, containing, as it does, information that is in general very difficult to obtain.

General Conclusions

The following summary of the general report of the committee gives in brief the general conclusions which may be made from the data and information collected up to the present time, and is from the Engineering Review:

(1) At the home ports, Baltic timber, which has been properly creosoted, would resist the attack of teredo or limnoria to an extent which would justify the adoption of such treatment.

(2) The life of sea structures in connection with home ports, would be further prolonged by the use of greenheart and, to some extent, by the employment of jarrah, and other Australian gums, in lieu of creosoted timber.

(3) In tropical waters, where the teredo and limnoria are much more active than around the British coasts, the use of creosote as a protection, or preventative, would not be justified by the results produced.

(4) It is possible that experiments contemplated on improved preservations may enable better results to be obtained with softer woods adapted for impregnation at home and in the colonies.

(5) Hard and dense woods are not adapted for this preservative treatment.

(6) Reinforced concrete is a more favorable material than wood for use where the sea worm is very active, both at home and in the tropics, provided such a system is applied in a proper manner.

(7) In carrying out reinforced concrete structures, both at home and in the tropics, it is of the utmost importance that a sufficient thickness of cover for the reinforcement, say, not less than 2 to 2½ inches, be provided, and that the materials are so proportioned that the concrete is impervious.

(8) It is of special importance that careful workmanship and supervision should be employed in carrying out reinforced concrete work, and that the displacement of the reinforcement should not occur during the deposit of the concrete.

(9) Ordinary concrete, whether in blocks or en masse, may be considered as producing thoroughly permanent work, if carried out on the lines indicated in detail in the report.

(10) The committee defer the expression of an opinion on the relative suitability of iron or steel for use in steel structures until the experiments, for which arrangements have been made, are sufficiently advanced to enable a reliable opinion to be formed.

Features of the Report

The report, which is edited by P. M. Crosthwaite, B.A.I., M.I.C.E., and G. R. Redgrave, Assoc. I.C.E., opens with a useful abstract of references to the subject contained in the Proceedings of the Institution. Next follows a paper by Mr. H. W. Fitz-Simons, in conjunction with Mr. F. T. Brooks, discussing the conditions that contribute to the value of timber as a material for marine structures. Dr. W. T. Colman deals with the subject from the biological standpoint, and gives a useful explanation of the structure and life habit of boring animals, the account given of the ship worm or teredo being particularly interesting.

The special general articles conclude with an able contribution on the Corrosion of Iron and Steel by Dr. J. Newton Friend, who promises further contributions when experiments, now in progress, are completed.

The remainder of the report comprises extracts of reports sent in by corresponding members in various parts of the world. Many of these reports were accompanied by specimens, preserved by the Committee, to act as the nucleus of a museum which will be of great value and interest in the future.

Timber Structures

As indicated in the summary given above, the use of creosoted timber is attended with variable success in home waters, and is practically a failure in hot countries.

The report contains a number of photographs showing the effects of the teredo in eating away timber; this gentleman does not appear to object strongly to creosote, but does not much like the flavor of Australian gums.

In the case of timber, there are two distinct aspects of the problem to be kept in mind; one is the determination of the timber possessing properties which are most resistent to the action of the boring animals; the other is the investigation into the most effective method of preventing such animals from attacking a given kind of timber.

Metal sheathing—lead and Muntz metal—has been used with varying success, but great difficulty is met in properly covering the joints between the timbers in braced structures. One form of covering, known as "scupper nailing," consists of flat-headed iron nails driven into the timber, so nearly touching each other that the space between them may rust over and form practically a continuous rust coating; in some cases it is doubtful whether this cure is better than the disease.

One of the peculiarities of the problem is that with two piles nearly in contact, one may be taken and the other left.

The reports from widely different localities are practically unanimous in dividing timber into greenheart and others.

Concrete

The report is, on the whole, very favorable to concrete as a material for resisting deterioration under sea action. When we remember that concrete, in the form of reinforced concrete, in which it is now most generally used, is a comparatively new material, and that mistakes are inevitable in the first uses of it, we must be impressed by the very good record which engineers all over the world give of its action. Most of the failures with reinforced concrete can be attributed to the corrosion of the steel reinforcement due to the penetration of water through the concrete covering. There are, however, some factors which must be taken into account. Mr. Wentworth Shields, for instance, has found that at Southampton the rust action takes place only above high water level, and that below high water neap tides, where the piles and bracing are constantly wetted, the concrete is quite unaffected. Mr. Kirkpatrick, of the Port of London, suggests that during the drying of the wet metal corrosion proceeds rapidly, as it is in contact with the air; consequently where the concrete cover is thin and moisture finds its way to the steel in wet weather, we may expect that corrosion will ensue in the periods of fine weather, as evaporation continues, and causes the concrete to crack.

Evidence shows that the first sympton is the appearance of small spots of rust on the face of the concrete. Corrosion next extends in the direction of the reinforcing rods, and cracks can be perceived; then once a crack is started, water gains access to the steel, and the expansion under corrosion forces the concrete away from the bars and sometimes quite exposes them.

Insufficient experience appears to have been gained with the use of tar, ironite, and other surface treatments for preventing access of the sea water to the concrete.

One point of considerable importance is that none of the correspondents attribute defects in the reinforced concrete to the composition and character of the concrete itself; this indicates that the condition necessary to product good concrete in practice are now well understood. In very cold climates, as at Halifax (Nova Scotia), frost may be the cause of injury to the concrete; if water penetrates the surface of the concrete at high tide, the water in the concrete may freeze and expand when the tide falls. On thawing again with the rising tide, the surface film of concrete falls off in powder; for this temperature effect waterproofing is the only remedy.

The Committee is in favor of using Portland rather than Roman cement for sea work, and disapproves the use of lias or hydraulic lime in concrete.

Iron and Steel

The action of sea water upon cast iron, wrought iron and steel is different in each case, but the extent of the deterioration, its causes, and its prevention cannot at present be decided with certainty. Steel, as a rule, shows signs of decay more quickly than wrought iron, and cast iron is more resistent than either. Up to the present we have very little information as to the action of sea water on alloy steels.

In his article on the corrosion of iron and steel, Dr. Newton Friend points out that corrosion may be considered under three different heads:

(1) Rusting, due to the formation on the surface of the iron of a brown, porous and friable coating of hydrated ferric oxide.

(2) Graphitisation, caused by the more or less complete conversion of the metal into ferrous oxide, which retains the original shape of the metal and which, in the case of cast iron, is admixed with the unaltered graphite; the oxidized mass is soft, and can be easily cut with a knife. This form of corrosion is most common with cast iron, but it has also been observed in the purer forms of the metal.

(3) Solution with acid. Iron is readily attacked by the majority of acids, even when they are dilute; there is often no formation of rust or basic salt in the presence of air, and the surface of the metal remains bright, although it is continuously passing into solution.

Cast iron piers exist in very good condition at Gravesend, after having stood the wear of seventy-three years' tidal variations. At Holyhead, cast iron columns erected fifty years ago show no signs of severe deterioration, although both there and at Dublin the conversion of the surface of the metal into a soft ferrous oxide has been noticed.

The committee intends to extend its investigations further and to undertake important researches, and it will be clear that a work of great magnitude has been started. We have no doubt that the institution will use its great reserve of facilities to complete a work which will be of great and lasting benefit to engineering science.

Winnipeg Parks Board is considering a proposition for two new entrances to Assiniboine park. The scheme provides for the construction of a $130,000 traffic bridge from Portage Ave. to the west end of the park and a new foot bridge 14 feet wide over the river at a point about 150 feet west of the existing pontoon bridge. Both bridges will be erected if arrangements can be completed satisfactorily. The traffic bridge is proposed to have two sidewalks, two car tracks and two roadways. The footbridge is to afford an avenue nearer the eastern section of the park.

Machinery for Road Construction Purposes

Purchase of Equipment is Justified if Money and Time Can be Saved—Paper Read Before Canadian Good Roads Congress

By Arthur H. Blanchard*

UNDER the general title of "Road Machinery" will be discussed the various machines used in grading operations and in the construction and maintenance of earth, sand-clay, gravel, and broken stone roads.

The purchase of an ideal road machinery equipment will be justified, and is wholly advisable, if the work is to be extensive in character. As a fundamental economic principle, maximum use should be made of time and labor-saving machinery, due especially to the high cost and scarcity of common as well as skilled labor.

Before purchasing a special type of machine which has been designed with a view to reducing to a minimum the cost of a certain class of grading or construction, the probable scope of work to be carried on by a department or contractor should be analyzed to determine if the amount of one kind of grading work or construction will warrant the purchase of the special machine, or if, in the long run, such work should not be done with more ordinary types of machines at a slight increase in cost.

Depreciation Charges Must be Carefully Considered

Depreciation charges on plant equipment always should be given careful consideration prior to the purchase of machines and accessories, as well as in estimating the cost of highway work. The larger types of grading machinery usually must be used for a considerable precentage of the working season, as otherwise such overhead charges as interest on first cost, cost of housing or storage, etc., will be prohibitively high when applied to the cost of a unit of grading on a given piece of work.

If an organization does not include men who are specialists in the manipulation of complicated machinery or if skilled labor is not economically available, simplicity of machines and ease of manipulation should be given great weight in the selection of eqipment. For example, common labor may efficiently perform grading work with scrapers, shovels, wagons, etc., while skilled labor will be required to operate a steam shovel or an elevating or traction grader. Again, graders may be hauled by animals driven by ordinary labor, while if traction engines are employed, skilled labor must be utilized.

The following paragraphs will be devoted to brief descriptions of the various machines used in grading operations and in the construction and maintenance of roads; methods of operation; and comments pertaining to their efficient use.

Carts and Wagons

A one-horse tip-cart is generally built with two wheels, the body of which tips over the axle in discharging its contents. The bodies, without side-boards, have a capacity of about 21 to 24 cubic feet. Two-horse tip-carts are operated on the same principle, but are built on 4 wheels and hold about 1½ cubic yards of material. Patent bottom dump-wagons are made in 1, 1½, 2, 2½ and 3 cubic yard sizes. The bottom of the wagon is made up generally of 2 leaves, hinged either to the sides or to the ends of the box. The doors are held in place with chains which are wound up on a windlass, operated by the driver. To dump the load, the driver with his foot kicks a release lever and the doors fly open, thus discharging the load. The doors are closed by the driver turning the windlass. While the body of the wagon is generally made of wood, the bottom doors are sometimes made of wood and sometimes of sheet-iron. One of the doors is usually provided with a lip, which overlaps the joint formed by the doors, and thus prevents the material from shifting through.

Plows and Drag Scrapers

The grading plow is so made that a furrow may be turned over to the left or to the right. An ordinary grading plow will make a furrow about 10 inches wide and from 6 to 10 inches deep. For breaking up hard-pan, or other stiff material, a rooter plow is employed. A plow of this kind is generally pulled by a steam roller or a tractor.

A drag scraper consists of a pressed steel bowl to which a bail and handles are attached. They have capacities from 3 to 12 cubic feet. This form of scraper wears out rapidly on its cutting edge and on the bottom, particularly when working in hard-pan or gravel. A drag scraper is usually drawn by one or two horses. To load, a man grasps the handles and pushes the cutting edge into the loosened earth as the scraper is pulled along. Then the full scraper is dragged along on its bottom to the point of dump, where either the driver or a dump man takes hold of one or both of the handles and lifts the scraper so that it turns upside down about its cutting edge.

Wheel and Buck Scrapers

A wheel scraper is similar in shape to a drag scraper, but the bowl is fixed to 2 wheels fitted with a pole and is usually drawn by 2 horses. They have capacities of 9 to 18 cubic feet. Scrapers with 4 wheels are also manufactured. A wheel scraper is operated as follows: As it is pulled through the plowed material in its lowered position. a man grasps the small handles at the rear of the bowl and tilts the bowl so that the cutting edge engages the earth. When the scraper is full, he pulls down on the long lever at the rear, which raises the bowl from the ground.

This type of scraper is also known as a Fresno grader. It consists of a bowl or scoop resting on runners. It is generally drawn by 4 horses and loads and dumps in the same manner as described for wheel and drag scrapers, except that it rests on runners while being dragged into position for reloading.

In ordinary grading operations, drag scrapers have been used for lengths of haul up to 200 feet; wheel scrapers for hauls between 200 to 600 feet; and for lengths of haul above 600 feet, wagons have been employed.

Road Graders

The 4-wheel machines have blades from 7 to 8 feet long, made up of 2 parts, a cutting edge and a mold board. By turning large wheels located above the operating platform, the blades may be tilted at any desired vertical or horizontal angle. In using a road grader, a cut is first made at the edge of the ditch using the point of the blade. On the next round the blade is lowered to a flatter angle and the earth is moved along the blade to the centre of the road. By making several rounds with the grader in this manner, the roadbed is crowned up at the centre. To smooth out the road-bed, the surface is first thoroughly harrowed to break up the large lumps and then the grader is drawn along the road with the blades set at right angles to the centre line of the road.

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*Professor of Highway Engineering, University of Michigan.

Elevating Graders

The principal parts of the elevating grader are the plow, mold board and the elevating belt. The mold board back of the plow is shaped so as to deliver the furrow of earth to the elevating belt with as little loss as possible. For heavy work, the grader requires 2 horses, 2 drivers and 2 operators on the machine, who operate the various levers controlling the movements of the plow and belt. In many cases a traction engine is used in place of horses. The grader, as it moves along, plows up the earth, which is thrown onto the elevating belt and discharged over its end, either onto the road or into wagons.

Steam Shovels

A portable revolving steam shovel has proved very efficient in highway grading operations. This type of steam shovel has been used for excavating earth, hard-pan and small boulders. It may be used on cuts varying from 6 inches to many feet. It is generally employed to excavate and load material into wagons.

Road Drags

These machines are used for finishing the surface of subgrades, earth, sand-clay and gravel roads and for the maintenance of the types of roads mentioned. One of the simplest and cheapest forms of road drags is the split-log drag. It is a home-made tool, but is extremely useful in maintaining an earth road, and is to-day preferred by many to the steel drag. A dry red-cedar log is best, although red elm, walnut box elder, soft maple, and willow make good drags when thoroughly dry. A log should be from 7 to 8 feet in length and from 10 to 12 inches in diameter. The log is split as nearly in half as is practicable, and the heaviest and best slab is used for the front log. The logs are braced together. The diagonal brace at the end runs from the middle of the back log to within 1 inch of the bottom of the front log. An iron strip is fixed at the ditch end. It projects ½ inch below the lower edge of the slab at its outermost extremity and is flush with the slab at its other end. If the front log stands plumb on the face, the iron strip may be wedged out, or if the log has a wind in it, this may be taken advantage of in giving the iron strip a pitch. A platform of 1-inch boards is placed over the cross braces on which the driver stands. The boards of the platform are fixed about 1 inch apart to allow any dirt that comes onto the platform to sift through onto the road again. The chain is put through the middle of the log at the ditch end and passed over the top of the log at its other end and fastened to the brace. This allows the dirt to pass underneath the chain as it runs from the ditch along the log to the centre of the road.

A plank-log drag is built in a similar manner to the split-log drag except planks, set on edge, are used in place of the split-logs, the planks used being 10 to 12 inches wide and 2 to 4 inches thick. Lap-plank drags are used for smoothing up a road where only a small amount of material is to be moved.

Various forms of steel road drags are now manufactured, which have about the same over-all dimensions as the split-log drag described above, the logs or planks being replaced by angle irons or steel plates placed on edge. They weigh considerably more than split-log or plank drags, and for this reason are not preferred by some. Steel drags are often equipped with a lever by means of which the blades are made with three parallel blades instead of two and are provided with braces, which, when the drag is turned upside down, serve as runners on which it may be drawn from point to point.

Operation of the Drag

In operating a road drag, a team is hitched to the chain so that the drag will be pulled along the road without a load at an angle of about 45 degrees with the centre line, the ditch end always being ahead. If it is desired to make the drag cut deeper, the chain should be lengthened as it is obvious that the nearer the team is to the drag the more the tendency to lift it from the ground. The driver generally stands on the drag when working, and by shifting his weight from one end to the other, causes the drag to cut into the soil or to drop, the soil being carried along by it. To cut, he shifts his weight mostly on the front runner towards the ditching end; to cut light, he shifts his weight towards the rear runner; to drop the earth carried along into a depression, he suddenly shifts his weight to the rear and towards the end of the drag nearest the centre of the road. Some of the steel drags are so heavy that they cannot be operated in this manner, and hence are not so adaptable to the work.

Rollers

Horse, steam and gasoline rollers are employed for the compaction of embankments and roads of earth, sand-clay, gravel and broken stone.

Horse Rollers.—A horse roller is generally made with one large roller having a face of about 5 feet and a diameter of about 5 feet. Any weight desired from 2½ to 5½ tons, varying by 1 ton, can be obtained. Additional weights may be placed in the boxes at either end of the frame and the weight be thus increased by 1 ton. The roller is made of steel or cast iron. An essential feature of a horse-drawn roller is to have it reversible, so that it can be drawn in either direction.

Three-Wheel Rollers.—Three-wheel rollers vary in weight from 10 to 20 tons. The majority of rollers of this type are run by steam, although there are a few makes which are run by gasoline engines. Rollers are generally furnished with a high and low speed. The low speed is used in rolling embankment, subgrade, telford, etc., while the high speed is used in finishing the surface or in travelling from point to point.

S arifiers.—These machines consist of a heavy cast-iron block on two or four wheels which hold a series of steel picks. The blocks weigh about three tons and the picks can be adjusted in the blocks or the blocks themselves arranged so that any depth desired up to 5 or 6 inches, can be picked up. The picks are arranged in either a straight line or in two lines which, together, form a V. Most of the scarifiers are so designed that it is not necessary to tur them around. This is accomplished generally by having two sets of picks, one set being used when the machine runs in one direction and the other when in the opposite direction. Scarifiers of this type are towed by a chain hitched to the roller. The arrangement of the picks and the form of the blocks vary, but all of the machines work on the same principle. Scarifiers are of particular value when used in connection with the resurfacing of roadways of gravel or broken stone.

The Sawyer Wall System

A New Hollow Wall Construction That is Claimed to Have Many Merits—Units are Factory-Made

AMONG the more modern methods of construction none have witnessed more rapid development than those associated with concrete. The use of this material involved many new problems for engineers, contractors, and those engaged in scientific investigation. The high cost of all concrete structures, due to the excess amount of concrete used in a solid wall, also to the wastage and labor of making and tearing down wooden forms, has been one of the most important objections to its use, this high cost having more to do with retarding the advancement of concrete as a building material than any other thing. Another objection is that a solid concrete wall is not a weatherproof wall.

Before the Sawyer system was invented, builders and engineers had for many years failed in their endeavor to construct an inexpensive hollow wall of concrete, without weakening the strength of the wall. The above mentioned scheme, however, gets over the difficulty. This system is the invention of F. McMurray Sawyer, an architect of Los Angeles, Cal. The license for Canada is controlled by the Canadian Self Locking Concrete Wall Co. Ltd., Suite 18, 207 St. James St., Montreal.

By this method there is a two-piece self-locking sectional wall, which is practically monolithic in construction, with none of the disadvantages of a solid concrete wall. The wall is built without the use of wooden forms and consists of two units, namely, the main slab and locking (or key) slab, which are both shaped so that each dovetails into the other, in such a manner, when placed in the wall, that the interlocking part of the slabs form a space which is poured with grout (concrete) and locks the wall together, forming concrete self-aligning studs or columns, every 16 inches for the full height of the wall. These columns can be reinforced if necessary to carry extra heavy loads. The cement slabs form two parallel curtain walls, serving to perfect the construction by forming a hollow wall which is absolutely moisture proof.

To finish the exterior, a coat of stucco (cement plaster) is applied uniformly on the surface. This is a very satisfactory finish, for the slabs present such uniform surface that the average thickness required is not more than three-sixteenths to one-fourth of an inch. This thin coating, knitting, as it sets, to the concrete slabs, forms a coating which will not crack or check. The coat of stucco, working into the V-shaped grooves produced by the bevel of the slabs, and into the vertical grooves of the stud section, knits the wall together into a solid monolithic mass. The plaster on the interior acts in the same way and requires no furrows or laths.

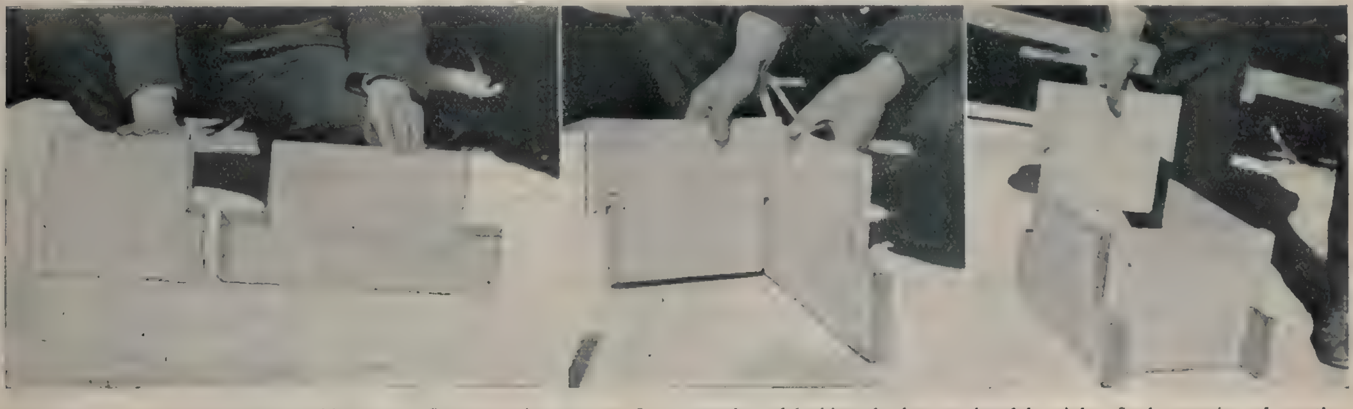
The cuts illustrate the method of construction. No. 1 shows the wall slab and the key slab or locking cross slab; while cut No. 2 shows the method of locking the key slab to the wall slab. The third cut shows the final operation of creating a unit of wall, equalling one superficial foot of wall space. The key slab runs from six inches in wall width up to any width, reducing two inches per storey.

There are several systems of erection, the most popular the smaller or house construction, usually starting with 12-inch wall thickness of basement up to the first floor level. Where the city by-laws call for a solid foundation wall, the contractor simply pours his air insulations full, and then reduces the key or width of wall to 9 or 10 inches and erects the first storey, the reduction allowing three inches for hanger for floor joists, etc.

Upon reaching the first floor level, for the second storey he either pours a four-inch thickness of plate continuously round the wall or constructs the plate with precast 4 to 6 in. slabs. For the second storey he reduces the key two inches, the floor joists being hung on the plate. A similar plate is poured or constructed for hanging the roof on.

The exterior finish can be of any material, such as brick, tile, or stucco, and in the majority of cases the interior finish is plastered directly to the wall.

The chief advantages of the material are: cheapness in first cost; reduction of from 35 to 50 per cent. in time of erection; the majority of labor is unskilled, as the foremen do practically all the skilled work necessary; placing in of doors, windows, etc., saves 50 per cent. of the time; reduction in fire insurance



Left: the key and wall slabs making up a Sawyer unit; centre: first operation of locking the key to the slab; right: final operation of creating a unit rates, and practically no renewal or upkeep to the building when once erected.

A company has taken over the rights for Manitoba and Saskatchewan; this is operating under the name of the Manitoba Self Locking Concrete Wall Co., Ltd. The company have a plant in Winnipeg, and at present are designing country grain elevators, and hope, through the reduction in cost and permanency of construction, and also the elimination of fire, vermin, and damp risks, to be able to develop a very large business in the erection of new elevators and replacements throughout the West. The material is also used for bridge approaches, piers, buttresses, etc., contractors finding the material to be more economical than wooden form work. Where solid construction is required contractors simply fill the air chamber and reinforce to any extent. The system is based upon the assumption that no city ordinance will allow more than five hundred pounds per square inch carrying capacity, and in consequence the material is overstrength for the majority of Canadian cities and towns.

Upper: battery of moulds for making slabs; centre; battery of moulds on rocking trucks ready to enter steaming room; lower: steaming shed of the Manitoba Self-Locking Concrete Wall Co., Ltd., Winnipeg

Moulds, as used in this system, are made of light wood, with strips and pieces of wood nailed to them so as to form whatever desired shape-unit is wanted. These moulds are then stacked or placed together to form a series of multiple cells, each one of which is the mould for a concrete unit. A level floor is used as a pouring place, the moulds are stacked vertically, and in accurate alignment and clamped tightly by screw-jack or clamp arrangement. It is common practice to pour the mixture into more than one row of cells at a time, as rows of moulds can be stacked alongside of one another without interference. Pouring is done with a wet or slush mixture, and the equipment can be adapted to meet the condition and size of the structure that is to be built. After the moulds are filled, they are cured for twelve hours by wet steam. The clamps are then loosened, the segments or concrete units being lifted out and stacked to further cure for twelve hours and the moulds restacked and poured again.

The mixture is of such richness and consistency that the product can, within a very short time, be handled with little or no danger of any breakage occurring.

Factors Which Will Limit Highway Construction During the Coming Season

By Richard Hopkins*

LABOR is so scarce and so unsatisfactory under our present industrial conditions and the highway program so large, that any suggestions that can be put forward to do a larger mileage of work in 1920 with the actual labor available are eagerly listened to by engineers and contractors engaged in road construction.

What has to be done can be done, and we all have our ear to the ground for ideas that can be whipped into shape to produce faster and better work. Important roads closed for construction will actually mean a loss of from $50 to $500 a day to the traveling public, so that highway officials are intensely interested in a contractor's plant and his methods, and will absolutely insist upon rapid construction. They will quickly discard non-essential details in specifications which hamper progress, and will critically study the contractor's plan of operations and help in every way they can to get a good job done quickly.

Nobody has made a deeper study of proper methods and proper machinery than manufacturers and their salesmen. At the present time they are in a position to advise the contractor, after an inspection of his job as to the proper plant and the proper methods to use in the economical building of the job, and they are rendering a service that is being appreciated more every day.

The subject of "Labor Saving Devices" will be taken up under three headings—Grading, Asphalt Roadway and Concrete Roadway.

Grading

Jobs where the excavation exceeds 5,000 yd. per mile, and where a large proportion of the hauls are long, will generally call for a steam shovel. Where hauls are short and cuts small, scraper work will continue to hold first place. No grading job is complete without wheelers, drag-scrapers, fresnos, and at least one road machine.

Each of the three types of scrapers is more economical than either of the others under certain conditions, and for the small extra investment in plant it is foolish to be without at least a few of each one of the three kinds. Most contractors have in the past erred on the side of having their wheelers too large and their drag scrapers too small. The fresno of a 4-ft. width is the proper size for the average job.

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*Contractor, Troy, N.Y., before American Road Builders' Assn.

In case of shovel break-down, the teams can be put on scrapers until shovel is repaired. The road scraper is the most maligned and the most neglected grading tool we have. A good operator is essential and with one, much good finishing work can be done cheaper than by any other method. There is a big range of sizes available, so it is an easy matter to choose the one best suited to the particular job.

It is advisable to carry rough grading and finished grading along together, as the latter can always be done more cheaply while the dirt is mellow. Specifications are growing more stringent in the matter of rolling in thin layers. This requires a big labor expense on the dump, especially with steam shovel work. A team on a 4-ft. fresno will take the place of 6 men on the dump, and spread the dirt evenly for the roller. In this connection, it is well to remember that, aside from a steam roller, nothing has been found that equals the compacting effect on a fill of horses tramping over it.

The rotary grader has been on the market only a short time, but large capacity and cheap costs have been reported. It works rapidly in loam or gravel, and cuts accurately to grade. It also cuts macadam readily, and a stone screening attachment can be provided if a contractor desires to save the old crushed stone. The old-time rooter plow and scarifier are tools that will always be used when a small amount of old macadam is encountered. Most plow companies now make a heavy moldboard plow with a narrow cut that is more successful in real hardpan than a rooter plow.

In shallow cutting with a steam shovel on old macadam, it will generally be found best and cheapest to cut a few inches below grade, and dump every third or fourth dipper-full behind the shovel for the fine graders to bring the sub-grade back to the correct elevation. Where a roller is fitted with a scarifier attachment, it is sometimes found that a lot of expensive hand work can be saved by its use. It is recommended that where the subgrading machine or planer is used between concrete forms, a steam roller be used to pull it. The roller is necessary for rolling the subgrade, and its use in pulling the planer dispenses with the need of providing a traction engine.

Asphalt Roadway

Pentration Work.—When the first penetration work was done the bituminous material came on the job in wooden barrels, was heated in a small kettle and poured on the stone with a small hand-pot. The great bulk of material at present arrives in tank cars, and is heated by steam. Roller and horse-drawn distributors are now on the market that apply the hot bituminous material at a high and uniform pressure and thus get a good, even penetration. Auto truck distributors with a central station are now located in various parts of the country, and a number of these will make deliveries at as great a distance as 40 miles from the central station. During the past years the use of low-pressure steam for heating has been largely discarded, and high-pressure steam is being used on all new installations. It is possible to use an old low-pressure boiler and put a small super-heater between the boiler and the tank car and get fully as good results as are gotten with a high-pressure boiler.

No mechanical methods of spreading stone for macadam roads are recommended, as a man who knows how to spread stone can build a smoother road than can be gotten by any machine.

Material Dumped on Subgrade.—By this mehod there is an average loss of about 5% on material, and where all the materials are high priced this becomes a very appreciable item at the end of the job. Where material is kept a long way ahead of the mixer, this material serves as a big stock pile placed where it is instantly available for the mixer. In these times of poor material deliveries, this subgrade method of storing finds many advocates because of being able to keep the mixer running. It is not a bad plan to have a few small stock piles of sand and stone scattered at various points along the edge of the road so that if the material at the mixer begins to run a little shy, a small amount of sand or stone can be brought in with a one-horse cart to meet this deficiency. The biggest disadvantage of stocking stone and sand on the subgrade is that the materials are hauled through fresh grading, and after a heavy storm it is difficult or impossible to get through for a while. Also, after a heavy storm a motor truck loaded with material will have a churning effect upon the subgrade. There are three methods of handling this material from the subgrade to the mixer.

Wheel-Barrow Method

With wheel-barrows, materials should be placed correctly so as to avoid both long wheeling and short wheeling. Short wheeling always makes a crowded and cluttered condition at the mixer and interferes with progress. All wheeling should be done on wooden run-ways. The mixer loader is a long conveying belt actuated by a gasoline engine. Above the belt are small hoppers into which the men shovel the material from the subgrade. This does away with the wheel-barrows, but not with the shovelers. One of these machines will save about 5 men. A self-propelling crane at the mixer will save about 12 men. With both the mixer loader and the crane the job is speeded up, and more batches per hour will be turned out than by the wheel-barrow method.

A movable bin at the mixer with a loading attachment has been suggested, but this is open to the criticism that material arriving at the bin in motor trucks must come in a fairly constant stream, as the capacity of a bin would be only a few batches and any delay in the transportation would mean a delay at the mixer.

Batch Transfer

The batch transfer method saves from 75 to 80 per cent. of the men at the mixer. It is generally used in connection with industrial railway haulage, and each batch, containing the proper amount of cement, sand and stone in a box or a car, is hoisted and dumped directly into the mixer. There can be no argument that this method results in less loss of material, avoids cutting of subgrades and allows more working days per month for concreting than any other method thus far tried. The original scheme of operating entirely by industrial track requires a length of track equal to the distance from the unloading point to the farthest point of the job.

Recently a plan, modified as to haulage, has been advocated by some manufacturers and contractors. It involves the use of 6,000 to 8,000 lin. ft. of track, with the necessary switches, cars and locomotives. The concrete mixer is started at the point nearest the unloading station, and approximately the first mile or mile and a half of the road is built by the industrial haulage method entirely. The portion of the track nearest the railroad station is then taken up and moved ahead and a temporary stock pile is made, or bins are set up at a point approximately 4,000 ft. away from the railroad station. Material is hauled to this point over the finished concrete road in motor trucks, and is then transferred to the batch boxes on the industrial railroad, and from this point on, the regular batch transfer method is followed. When another mile of road is completed, the position of the bins or stock pile is moved ahead to the farthest point of the concrete road which has had the necessary minimum time for curing. The application of this method results in the following:

The industrial railway haul is very uniform; the number of men required on trains and track remains the same, and the flexible part of the hauling is in the number of motor trucks used. The motor trucks can always be hired; they can work long hours, and the hauling cost per ton-mile over finished concrete roads is low, where there is only a small delay in time in loading and unloading.

The advocates of this method point out that while their costs include a second handling of material, their plant charges are very low compared with a regular system of industrial haulage. A contractor who has 5 miles of track to build 5 miles of road has half of his equipment idle when 2½ miles of his road are completed, and 80 per cent. of his equipment idle when he has 4 miles of his road completed. This modified method possesses the same advantage as entire industrial haulage does in the matter of grading, which is entirely away from the mixer and in no way interferes with it.

Central Mixing Plant

Industrial engineers who are in the habit of placing thousands of yards of concrete from a central mixing plant are continually asking why a central plant is not used more in building concrete roads. A haul of 4 miles by motor truck or industrial railway is possible before the concrete takes its initial set. Where water from a municipal supply is available and there is ample yard room at the unloading switch, a central mixing plant can be fed from overhead bins and a surprisingly low labor charge and plant charge per yard of concrete can be obtained.

Unloading Methods

Wherever it is possible to do so, a trestle should be used for unloading. Frequently an existing trestle can be rented for a nominal amount and extended, if not already of large enough capacity. The economy of a short trestle is very much greater where the railroad company provides frequent switching service. Where only one switch a day is provided a trestle might be of doubtful economy, while the same trestle with two or three switches a day would be a very profitable investment. Bucket elevators run by gasoline engines and delivering to overhead bins continue to be a popular method of unloading. They of course require double the switch room of any other method. With a short switch track, frequent switching is a valuable help toward large daily capacity.

With both a bucket elevator and a trestle, battleship cars work better than any other type, and these are more easily obtained during the summer season than gondolas. A locomotive crane with a clamshell bucket can be used for direct loading, loading into overhead bins, loading onto a storage pile or onto a stock pile above a tunnel.

In providing a water supply the essential requisites are continuous service, ample supply and good pressure. Dual pumping plants are the best insurance for a continuous service. Where there is a point of high elevation near the road, a storage tank of 1,500 to 3,000 gal. capacity is also a big help. Ample supply and good pressure cannot be maintained with a small pipe line. Inch-and-a-half pipe should be used only on short line with a heavy gravity head. The 2-in. pipe line is in almost universal use and is satisfactory where the line does not exceed 1 mile in length.

Much better results on the average job will be obtained with a 2½-in. pipe line. Its use will become increasingly popular as construction men begin to appreciate how many of their pumping troubles disappear when this larger line is put into service. Where sources of supply are a long distance apart, booster pumps are necessary to provide good pressure.

In unloading bulk cement from a gondola car, a clamshell can be used. In unloading bag cement, two-wheeled hand carts will save one or two men.

Depreciation in Plant

Where a plant is assumed to have a life of 5 years, a great many people are charging off 20 per cent. yearly. A more correct way is to charge off about 40 per cent. the first year, 40 per cent. of the remainder the second year, 40 per cent. of the remainder the third year, and so on until the end of the 5-year period.

In conclusion, there is no better way of saving labor and getting maximum efficiency out of the labor available than by either the contract or the bonus system. The reason for this is very simple—a man will work hard and intelligently when it is to his direct interest to do so. Good camps, with a little touch of the human side in their management, will bring both profit and satisfaction to their owners.

Dominion Pier Tenders Have Been Opened

Bids for the proposed "Ballantyne Pier" to be built in connection with the Dominion Harbor Commissioners plans for development of the port of Vancouver, have been opened by the Commissioners and sent to the board's consulting engineer, A. D. Swan of Montreal. When he makes his report the board will later award the contract. In the meantime no further action has been taken with regard to the site chosen by the Commissioners, who are awaiting instructions from Ottawa carrying permission to tender a certain price offer to the Great Northern Railway, which has entered objections to selling the property. If the offer of the Commissioners is not accepted, the next step would be expropriation proceedings.

Dredge For Drainage of Low Lands

Designed especially for ditching and draining low-lying lands, such as exist in large areas in the lower Fraser valley, a large dredge is now in operation on a number of large contracts. This dredge is adapted to much work for which there has been a great call in the Fraser valley, especially with the demand for farm lands for dairy and fruit growing. During the present season it is anticipated that this new dredge will complete several miles of ditching in the vicinity of Agassiz. The dredge is 54 feet long, 15 feet beam. It is equipped with Beatty & Sons dredging machinery, double engined, and a dipper of 1¼ yards capacity works on the end of a 30 foot boom.

Houses for Grand Mere, P.Q.

The Town Council of Grand Mere, P. Q., has voted $57,375 (out of the $100,000 granted by the Provincial Government for building workmen's dwellings) to a local company, headed by Mr. J. L. Dostaler. The houses will be similar in construction and will each comprise six rooms and bath, with a large cellar. They will be of brick with fireproof roofs, each will have a large fireplace in the living room and each house being detached and in a large lot that will afford plenty of space for a garden and lawn.

LaSalle Bridge Dispute Settled

The long drawn out dispute over the construction of the LaSalle Bridge, Montreal, has been settled. The contractors did not complete the work, owing to the war, and the contract was taken over by the city. After provincial legislation, the following arbitrators were appointed to settle what was due to the contractors:—Messrs. F. C. Laberge, J. E. Vanier, and the Hon. J. P. B. Casgrain. These have unanimously signed the awards to contractors as follows.—Claim of Thos. O'Sullivan, $86,518.46, award, $53,500; claim of Pion and Grothe, $117,499.45, award, $87,500.

Mainly Constructional

East and West—From Coast to Coast

Last month's total value of building permits issued in York County, Ont., was $650,000, or a $150,000 increase over the corresponding month last year. These permits were all for houses.

At a recent meeting of the city council at Belleville, Ont., it was decided to adopt the Ontario housing scheme for the present year, and the following commission was appointed: Messrs. H. W. Ackerman, P. Fredericks and Mayor Riggs.

The city council at St. Catharines, Ont., has endorsed a proposal of the Chamber of Commerce for the erection of dwellings, and has guaranteed 80 per cent. of the bonds of a company to be formed for that purpose.

Tenders are now being called for the new Normal School at Saskatoon. This new building, which will be of brick and Bedford stone construction, will cost, it is estimated, about $500,000 to erect. An excellent site has been secured and a landscape scheme for the grounds is being planned.

The Home Building Association at Sarnia, Ont., has received its charter from Ottawa. The new association is working in conjunction with the Chamber of Commerce and the city council for the building of 50 workmen's dwellings. Mr. T. H. Cook, manager of the Home Bank, is chairman of the association.

Messrs. P. H. Secord & Sons Construction Co., Ltd., of Brantford, have secured the contract for the 16-storey addition to the King Edward Hotel, Toronto. This new building will contain about 500 bedrooms and will also provide additional office space. The cost of the addition, exclusive of furnishings, is said to be in the neighborhood of $2,500,000.

City Architect Price, of Toronto, has plans ready for submission to the council for the proposed live stock arena at the Exhibition grounds. The building was originally estimated to cost $1,000,000 and a by-law authorizing the expenditure of this amount was passed at the last municipal elections, but this original estimate will fall about $500,000 short of the present day cost of a building of the proposed type.

Mr. F. H. Welfley, who some time ago tendered his resignation as clerk of works to the Housing Commission at Winnipeg, has decided now to stay with the commission in consideration of an increase in salary. The commission has been active this year, loans so far approved amounting to $300,000. The erection of 82 houses has now been authorized and indications are that the objective of 100 houses built this season will be realized.

At a joint meeting of the Harbor Commission and representatives of several local municipalities, held recently at Vancouver, projects for joining the north and south shores of Burrard Inlet were discussed and plans and estimates were submitted by Chief Engineer W. G. Swan, of the Harbor Commission. The cost of a dam at the Second Narrows is estimated at $2,560,250, while the cost of a low level bridge would be about 33 per cent. more than the dam. The tunnel scheme was abandoned altogether as this would cost, according to Engineer Swan, about $6,000,000.

Personal

Miss Esther Hill, the first woman architect to graduate from the University of Toronto, received her degree of Bachelor of Applied Science at Convocation Hall recently.

Mr. Arthur H. Lee, secretary-treasurer of the Water and Light Commission at Woodstock, Ont., tendered his resignation at a recent meeting of the commissioners.

Mr. W. B. Callan, C.E., of Minneapolis, is at present in St. Thomas, Ont., preparing plans for the new dehydrating plant of the Elgin Milk Products Company which is to be erected there.

Mr. Romeo Morrissette, C.E., A.M.E.I.C., has resigned his position with the Department of Public Works branch at Three Rivers, Que., to accept a position with the National Shipbuilding Corporation in the same city.

The Civil Service Commission, Ottawa, announces the appointment of the following hydraulic engineers in the reclamation service: Messrs. G. F. Richan, Winnipeg; G. F. Horsey, Jr., Ottawa. Assistant hydraulic engineers: W. C. Warren, Ottawa; W. T. McFarlane, Ottawa; D. Whittaker, Ottawa; G. H. Wood, Ottawa; H. J. Cooper, Winnipeg; J. H. Byrne, Ottawa. Junior irrigation engineers: C. M. Moore, Calgary; J. H. E. Jaffray, Calgary.

Mr. James Govan, architect in the Provincial Secretary's Department, Ont., has been granted a month's leave of absence to go to New Mexico to take charge of the reclamation of a large area of waste land and the building of reformatories there. Mr. Govan was associated with the design and construction of the prison at Guelph, Ont., and the hospital buildings at Whitby, Ont., and the authorities of the state of New Mexico, hearing of his excellent work in connection with these two projects, have asked for the loan of his services.

Trade Incorporations

Galt Industrial Housing Company, Ltd., with head office at Galt, Ont., capital $100,000.

J. T. Davis, Ltd., with head office at Montreal, capital $250,000, to carry on the business of general contractors.

The Goldie Construction Company, Ltd., capital $50,000, with head office at Toronto, to carry on the business of engineers and contractors.

Contracts Department

News of Special Interest to Contractors, Engineers, Manufacturers and Dealers in Building Supplies

Waterworks, Sewerage and Roadways

Buckingham, Que.

Town has voted to set aside $75,000 for construction of alterations to waterworks system. Secy.-treas., David Ray.

Bowmanville, Ont.

John Lyle, Town clerk, will receive tenders until June 20th, for construction of cement sidewalks.

Ratepayers passed by-law authorizing construction of sewer to cost $16,000 for Town.

Fonthill, Ont.

Thorold Township contemplates construction of concrete sidewalks, Clerk, John A. Clark, Fonthill P. O., Ont.

Fredericton, N. B.

City is having plans prepared for construction of pavements. Engineer, Geo. McKnight.

Friar's Head, N. S.

R. C. Desrochers, secy. Dominion Dept. Public Works, Ottawa, will receive tenders until June 28th for construction of breakwater improvements. Plans with District Engineer, North Sydney, N. S.; P. O., Friar's Head, and Dept., Ottawa.

Grimsby, Ont.

T. W. Allan, clerk for Grimsby Township, will receive tenders until June 22nd for construction of concrete sidewalks on two streets.

Hamilton, Ont.

City plans the construction of vitrified sewers on 5 streets to cost $7,100, cast iron water mains on 3 streets, to cost $6,200, 36,000 sq. yards. asphalt pavements on 4 streets, and cement sidewalk on 3 streets. Engineer, E. R. Gray.

City plans to expend $5,000 on construction of pavement, $8,000 on construction of sewers, $15,000 and $30,000 on construction of brick and asphalt pavements on two streets. Engineer, E. R. Gray.

Leamington, Ont.

Town plans to pave street and lay sidewalks. Clerk, R. M. Selkirk.

Montreal, Que.

Administrative Commission will receive tenders until June 23rd for construction of permanent pavements on three streets. Plans at City Hall.

City will call tenders about June 31st for construction of 2 dams. Engineer, A. Des Baillets, 92 Duluth Bldg.

Niagara Falls, Ont.

W. J. Seymour, city clerk, will receive tenders until June 21st for construction of Muddy Run trunk sewer to cost $250,000. Plans with engineer, T. D. Black.

Oakbank, Man.

H. C. Christopherson, secy.-treas. for Municipality of Springfield, will receive tenders until June 19th for construction of 38 concrete culverts and headwalls for pipe. Plans with secy.-treas., and with Highway Commissioner, Winnipeg.

Oshawa, Ont.

By-law will be submitted for authorization of construction of extension to waterworks system costing $50,000, also erection of bridges. Town clerk, Thos. Morris, Oshawa.

St. Jean de Matha, Que.

Town is gravelling roads by day labor; cost, $70,000. Xavier Roy is supervising work.

Sturgeon Falls, Ont.

Town will receive tenders until June 19th for construction of 12,000 ft. of sewers, also for 11,000 ft. of concrete sidewalks. Plans at office of clerk, L. Rod Vannier.

Timmins, Ont.

H. E. Montgomery, Town clerk, will receive tenders until June 21st for construction of sewage disposal plant. Plans at office of engineer, J. F. Henderson, and Town Hall.

Town will call tenders at once for construction of sewage disposal plant. Consulting engineers, Sutcliffe & Neelands, New Liskeard, Ont.

Toronto, Ont.

Frank Barber, engineer for York Township, will receive following tenders: Until June 25th, for construction of 6 in. cast iron watermains on three streets, totalling 2936 ft.; until noon, June 26th, for construction of concrete sidewalks on 14 streets, Tarvia X pavement on Baby Point Rd. and Cres.. and concrete arch bridge over little Don River. Plans at engineer's office.

W. A. McLean, Deputy Minister Provincial Dept. Highways, will receive following tenders: Until June 25th, for supply of crushed stone on Provincial Highway in Elizabethtown Township, plans to be seen at Dept, Toronto, and office of Resident Engineer, Gananoque, Ont.; until June 25th for supply of crushed stone on Provincial Highway in Lancaster Township, plans to be seen at office of Resident Engineer, Cornwall, Ont., and Dept., Toronto, until June 30th for earthwork, rockwork and construction of concrete structures on Provincial Highway in Ancaster Township, plans to be seen at office of Resident Engineer, Paris, and Dept., Toronto.

Victoria, B. C.

Provincial Dept. Public Works, Victoria, will receive tenders until noon June 21st for construction of about 3.22 miles of macadamized road from Mara to Sicamous, B. C. Engineer, A. E. Foreman, Victoria.

Welland, Ont.

City contemplates construction of sewers. Engineer, Chas. F. Coulson.

CONTRACTS AWARDED

Bienfait, Sask.

Municipality of Coalfields No. 4 awarded general contract for road work costing $9,000 to E. A. DeLong, Regina, Sask.

Chatham, Ont.

Canadian Des Moines Steel Co., Inches Ave., will supply City with new pressure filters required in new waterworks plant. Cost, $13,497.

Galt, Ont.

City awarded general contract for construction of pavement, curbs and gutter to the Standard Paving Co., Central Chambers, Elgin St. Cost, $47,500

Issoudun, Parish of, Que.

Municipality placed the contract for gravelling roads with M. Normand & Normand, L'Islet, Que. Cost, $23,000.

Milverton, Ont.

Town awarded contract for pipe laying in connection with construction of waterworks system to Webster Construction Co., Bank of Toronto Bldg., London, Ont.

Murray Bay, Que.

M. Paul Trudel & Fils have the general contract gravelling road at $29,000 for Municipality.

New Toronto, Ont.

Town awarded the general contract for construction of sidewalks and sewer extension costing $40,000 to Central Foundation Co., 12 Wellington E., Toronto.

Sackville, N. B.

Town awarded general contract constructing 10,000 sq. ft. sidewalks to Sackville Concrete Co, York St, at 40c per sq. ft.

St. Jerome de Matane, Que.

Municipality awarded general contract constructing concrete reservoir or tank costing $6,000 to Alphonse Aubin, Metabetchouan, Que.

St. John, N. B.

City placed the general contract for paving City Rd with Stephens Construction Co., 257 Brussels St. Cost, $126,640.

St. Martine, Que.

Town awarded general contract constructing bituminous road to Leger Charleton, 15 Sussex Ave., Montreal.

St. Patrice de Sherrington, Que.

Town awarded the general contract for macadamization of roads to Dore Archambault, Ste. Martine, Que. Cost, $30,000.

Toronto, Ont.

City awarded contracts for paving streets as follows: Asphalt—Cunningham, $4,947, Rhodes, $20,390, York (Front to King) $16,497, R. C. Harris, Commissioner of Works; Davenport Rd., $60,387, Contracting & Paving Co., Continental Life Bldg.; York St. (King to Queen), $22,200, Godson Contracting Co., Manning Chambers; Bitulithic—Clendennan, $39,609, Colbeck, $20,192, Colbeck, $11,712, Western, $10,401, Woodbine, $26,907, R. C. Harris, Commissioner of Works: Brick block—Rhodes Ave., $13,268, R. C. Harris: Concrete walks—Day, Kingswood and Western Aves., R.

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The Normal Business Cycle—What Stage are We At?

THE "Commerce Monthly", published by the National Bank of Commerce in New York, contains a most interesting and altogether reasonable—as well as timely—article under the heading "The Normal Business Cycle." There is no special reference to the present time, nor is any opinion expressed as to what period in the cycle we may now have reached. It is rather an analysis of the underlying causes of periodic prosperity and depression, and as such is of very real value in assisting every business man to reach his own conclusions. With this in view we reproduce the article in part, elsewhere in this issue.

The business cycle, as outlined in this article, is devoid of the old-time panic which, it is argued, experience should have taught us how to avoid. A typical cycle consists of (a) depression, 10 months (b) revival, 10 months (c) prosperity, 10 months (d) financial strain (liquidation of securities), 10 months and (e) crisis, 2 months. It is claimed that with better understanding of the business cycle the period of prosperity can be lengthened and the period of depression shortened—in effect the curve becomes more nearly a straight line—and the crisis which brings every prosperity period to a close can ultimately be reduced to a relatively painless process of readjustments. The article says in conclusion: "The most important proposal that has yet been made for the mitigation of the extremes of the business cycle is that the various grades of government—federal, state and municipal—together with large corporations like the railroads, should adopt a buying policy designed to throw as many of their purchases as possible into the period of depression and to withdraw from the market in considerable measure at the height of the period of prosperity."

It is perhaps worthy of some attention that the two last most serious depressions occurred in 1893 and 1907—at intervals of 14 years. If this may be considered as establishing the duration of the cycle then we may look for a recurrence of those conditions in 1921.

Further Tax Regulations of Interest to Contractors

FURTHER reference to the operation of the new sales tax, so far as contractors and building supply men are concerned is contained in a members' service letter issued by the Association of Canadian Building and Construction Industries. Certain press reports, the letter states, which appeared under date of June 7th, stating that "sales tax is chargeable on the amount of contract between owner and contractor" are incorrect, the word "NOT" being omitted by the press from the statement issued by the Department of Inland Revenue.

A slight change is made in the following clause, from the previous statement in the Contract Record of June 9, page 522: "If a contractor or sub-contractor manufactures materials for his work, such as metal cornices, sash and door frames, iron railings, etc., he is required to pay tax **on the sale price of material manufactured by him.** He is not required to pay tax on installation."

The following rulings by the Department of Inland Revenue may be of interest, especially to supply men:—

Logs sold by logging firms, if not squared or processed, are not liable to the sales tax. Cordwood is also exempt. Mill scraps, sold exclusively for fuel, are not subject to sales tax.

Tax applies on importations or sales on and after May 19th, 1920. If goods from foreign manufacturer are invoiced to Canadian agents, and by them invoiced to purchaser, sales tax of one per cent. on the customs duty-paid value on importation, and sales tax of one per cent. on sale by the Canadian agents are both collectable.

A manufacturer or wholesaler importing raw material upon which the sales tax is paid, and who subsequently uses said raw material for the manufacture of his product, may properly regard same as a part of his cost, but must not include the sum represented thereby in that portion of the cost in which his profits are calculated.

Goods sold by manufacturer to jobbers at increased price due to luxury tax and sales may be charged by jobbers to retailers as cost, but not as part of cost on which profit is calculated. Sales by jobber to retailer are subject to additional sales tax.

On goods sold by manufacturer to jobber, for export, tax does not apply, if goods are shipped direct by the manufacturer to foreign consumer; but if goods are shipped to jobber in Canada, the tax applies.

One per cent. sales tax is not payable on freight where goods are sold f.o.b. factory and freight is paid for convenience of buyer and charged on invoice as separate item.

Re payment of sales tax by head office of a concern for its branches situate in other divisions: It is necessary, for statistical and other purposes, that arrangements be made whereby the tax accrued at the respective branches of a concern should be accounted for through the Inland Revenue divisions in which the transactions occur, and firms interested are requested to issue, if necessary, cheques in favor of their branches.

Sales tax of one per cent. is collectable on goods when sold by manufacturer, and again when sold by wholesalers and jobbers. In this respect, the tax is cumulative. All sales made by wholesalers, whether to retailer or consumer, are subject to tax. Sales by manufacturer to consumer are subject to tax.

What is the Immediate Outlook for Construction?

THERE are a great many factors affecting the immediate outlook for construction—rents, commodity prices, crop conditions, finance, all of which must be studied for their bearing on the outlook for any particular type of construction, writes W. A. Rogers, president of the Associated General Contractors of America, in the Association's bulletin. Rents may have to go higher before a normal program of new construction of many kinds can be profitably undertaken at present costs; commodity prices must be stabilized before normal industrial expansion can be realized; adequate crop returns are the basic indicators of adequate finance which governs all industry; and, while we hope there will be no disturbing economic questions such as the tariff raised in the coming election, yet in these days of government control and legislative regulation, the selection of a president and a national program will have much to do with the plans of all industry, including construction.

These are factors which no one can accurately forecast and to which each contractor must give the weight which, in the light of local conditions, he feels they deserve. No analysis of the future of construction, even for the coming six months, however, can be made without taking them into consideration. There are, nevertheless, three major factors which profoundly affect the outlook for construction, and which can be met by united effort and counsel. In order that any program of construction may be developed for the coming six months, we must first devise ways and means to adjust transportation conditions, establish sound price levels for construction materials, and secure from labor its full efficiency. In direct proportion to the extent to which these questions are settled, will construction of all kinds proceed.

Curtail Transportation of Luxuries

Ultimately, the transportation problem is largely one of rates and control. With adequate rates assured at the earliest possible date, the equipment and facilities of the roads can be maintained in relation to the demands being made upon it; and wages commensurate with the service rendered can be paid. It will take time, however, to repair present equipment, build new rolling stock and increase facilities. Meanwhile, we shall have to adopt some plan of sharing present facilities with other industries in proportion to the need for our products. Since rates cannot be shifted like prices, according to supply and demand, some other means must be adopted in apportioning transportation facilities. This means the re-establishment of priorities sooner or later in some form or other. Already this has been started. From present indications, if construction is not to be practically suspended in some sections of the country, construction materials must be given the right of way over the less essential commodities, second only to food and fuel. With inadequate facilities at hand, only by curbing the distribution of luxuries, which have jammed our freight houses and made use of cars which should have gone to more essential needs, can the present situation be handled and construction proceed.

Give Costs and Profits Publicity

Sound price levels are fundamentally a matter of publicity; for, with confidence in the justice of present prices restored which would follow full publicity of costs and profits, fear that a slump may be just around the corner will be removed. Then normal buying will be restored by the knowledge that lower prices can only be had as a result of slowly deflating the world's currency and slowly increasing the world's production, processes which will require time to accomplish. Without such knowledge, investors will hesitate to build and banks will hesitate to finance new projects.

Give Labor Incentives to Produce

To increase the efficiency of labor is mainly to create a new ideal in industry—the ideal of increased production. But such an ideal is of little value without an incentive behind it. During the war patriotism and the spirit of team-work for a common aim supplied that incentive. If workmen continue to demand increases in wages, shorter hours and decreased production, they may automatically create such an incentive in the competition among themselves for jobs, because of a slowing down in construction followed by idle workmen. Better, if means could be devised, to increase the efficiency of all construction labor at rates satisfactory to all.

The elimination of restrictions on output is fundamental. Moreover if some plan could be worked out by which there would be restored the mutual confidence between the contractor and the employee and by means of which it would be impressed on both that their interests were identical and that in the long run decreased production costs the workman as much as it does the employer, then a long step in the right direction will have been taken.

An Unprecedented Need for Construction

In spite of these things, however, and underlying them all, there is one outstanding feature in the

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Canada's Engineers—W. P. Brereton

Wilfrid Proctor Brereton, city engineer of Winnipeg for the past six years, was born in Bethany, Ont., in 1879. His early education was obtained at the Bethany Public School and the Port Hope High School. This was followed by a course in mechanical and electrical engineering at the School of Practical Science, Toronto, from which he graduated in 1901 with the degree of B.A.Sc.

Following his graduation, Mr. Brereton became chief draftsman of the Smart, Eby Machine Co., Hamilton, Ont., and in 1903 he joined the engineering staff of Heyl & Patterson, of Pittsburgh, Pa., two years later becoming manager of the McLaughlin Engine Co., Toronto. In 1906 he went West where all his subsequent experience has been gained. His first position there was as assistant engineer to C. B. Smith of Winnipeg. He became designing engineer, assistant to C. B. Smith, on the Winnipeg hydro-electric power plant, and later resident manager for the firm of Smith, Kerry & Chace, Portland, Oregon, on the hydro-electric development for the Mount Hood Railway & Power Co. Mr. Brereton then became assistant to Col. H. N. Ruttan, city engineer of Winnipeg and in this capacity designed and constructed the 18-million gallon covered reservoir for that city. In June, 1914, he was appointed to the position of city engineer, succeeding Col. Ruttan. Since that time he has been in full charge of all the city's works and engineering activities and has closely associated himself with the improvement of all the city's facilities. During the war, of course, expenditures were somewhat curtailed, but Mr. Brereton now has hopes of seeing conditions in the West generally, and in Winnipeg particularly, revive to an even more prosperous basis than they were several years ago.

Mr. W. P. Brereton

present outlook for construction: This is the unprecedented need for new homes, new highways, railroad improvements, and public works of all kinds which were postponed on account of the war, and which are today only subordinate to the nation's need for food and fuel.

The proportion of these which will be undertaken during the coming six months will depend upon the extent to which we solve the three major problems outlined above. When they have been satisfactorily dealt with, nothing short of a calamity can stop construction for long.

Light Colors Advocated for Bridge Paints

Light-colored paint for the finishing coat on steel structures, on the score of efficiency and appearance, was advocated at the annual meeting of the American Railway Bridge and Building Association by J. R. Shean, of the Pacific Electric Ry., Los Angeles, Cal. Unless the price of material is the main consideration he sees no reason why steelwork should not be painted in light colors, since their resistance to heat rays, as compared with dark colors, would be easier on the oil film which holds the pigment together.

Canary yellow, pearl gray or light olive green will change an unsightly black structure to one that will be at least more in harmony with the surroundings. These light colors, says Mr. Shean, will have a sufficiently longer life than the dark colors to pay for any difference in cost. It may be argued that light colors become unsightly in a short time from dirt and smoke. This cannot be noticed to any extent, he thinks, except overhead on through truss bridges and on overhead bridges, but even with black paint the smoke marks show conspicuously here.

Work of Ontario Division, E.I.C.

Important work is being carried on this year by the Ontario Provincial Division of the Engineering Institute of Canada. The Advisory Conference Committee, brought into being by the Ontario Division, is hard at work on the problem of legislation for the engineers of this province and is making good progress. Strong support is also being given the Niagara Branch in its arrangements for the professional meeting of the Institute to be held there in September. This promises to be one of the best meetings ever conducted by the Institute.

The City Council of Montreal has passed a by-law compelling the installation of dry sprinklers in buildings not of a residential character.

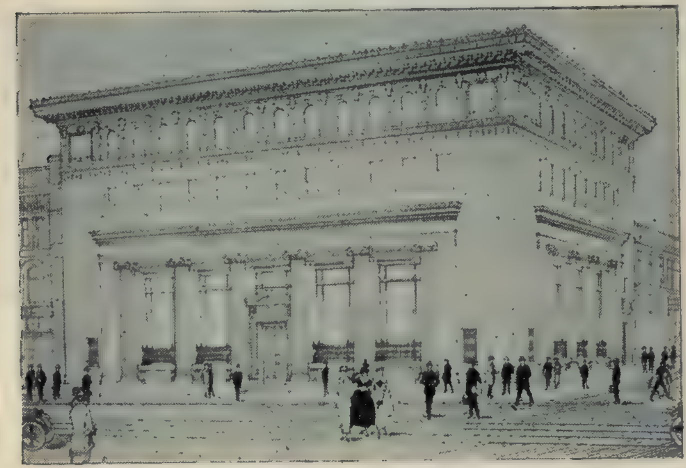
At a meeting of the Hamilton branch of the Association of Canadian Building and Construction Industries, J. P. Anglin, president of the association, said that the greatest profiteers were those who demanded a 50 per cent. increase in wages while giving only half production.

New Union Bank Building, Vancouver

Will be a Most Attractive Structure—Italian Renaissance Style of Architecture—Ornamental Work and Stone Carving of Local Design and Labor

OF the many handsome and substantial bank buildings erected in Vancouver during the past few years by Canadian banking institutions, none will excel in attractiveness the splendid block now under construction for the Union Bank of Canada. This new block, which will be the Union Bank's head office for British Columbia, will be finished in Haddington Island stone, the handsome and durable native stone used in so many of the large buildings in the coast cities. The building is designed in Italian Renaissance style of architecture. It is three storeys in height, and is of Class 'A' construction throughout, reinforced concrete being the material used in the work.

Begun in August last, construction has been carried on all winter and the structural portion of the work is now completed. The cut stone exterior is well on the way, and as it goes up some of the many artistic features are taking shape. The stone carving over the main entrance, the caps of the great fluted pillars of stone, and the window arches have all been executed in Vancouver, in the yards of J. A. & C. H. McDonald, stonecutters. The designs for these details were all drawn by Mr. Harold H. Ginnold, manager of Somervell & Putnam, architects of the building. Mr. C. Marega, the well-known Vancouver sculptor executed the models in staff, the full-size of each part of the stone carving, for the stone-cutters to work from. Mr. Marega is also modelling all the designs for the metal ornamentation of the interior, as well as doing all the wood carving on the interior finish.

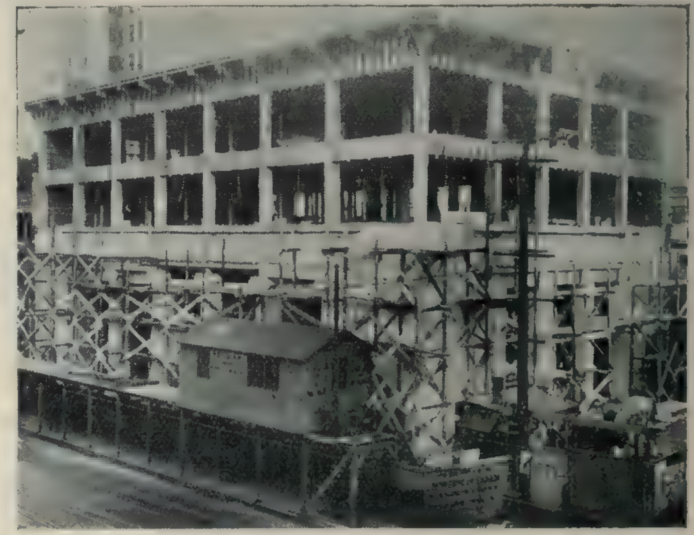


Prospective view of Union Bank of Canada Building, now being erected at Vancouver

For the main floor the plans show one large banking room, with no pillars or ceiling supports to break the space. This room, with a lofty 32-foot ceiling will be finished in Caen stone, and the fittings will be in Honduras mahogany, bronze and marble. A handsome design for the main entrance vestibule is in bronze, and it will cost $30,000, alone. Instancing the difficulty to secure choice materials, the architects found that in Honduras mahogany, which is worth now five or six times its price of a few years ago, the hardwood dealers of Vancouver are carrying the largest stocks on the continent to-day. It would be impossible to secure the amount needed for this one bank, anywhere else just at the moment.

The ceiling of the banking room is heavily decorated and a handsome design of old coin panels is worked out for the frieze. On the mezannine floor the space is laid off for directors' room, superintendent's office, watchman's room, and women's rest rooms. The basement is also given over to bank work space and valuts. Elaborate safe deposit facilities are provided, and in bank vault protection the architects have observed all the best practice, the whole installation being the last word in bank construction. Electrictity has been called in to do everything that can be suggested. There are telephone and dictagraph services, messenger call service, and every other modern electrical device. Every provision has been made, too, for the comfort and convenience of customers, and especially for the ladies, rest rooms, lavatories, etc., being included.

Practically every part of the material going into the construction of this new Union Bank building has been made in Canada or purchased in Canada or in England. Wherever possible all work has been done in Vancouver. Somervell & Putnam, H. H. Ginnold, manager, are the architects; Hodgson, King & Marble, general contractors; Barr & Anderson, Ltd., plumbing contractors; Leek & Co., heating and ventilation; Munday, Rowland & Co., electrical contractors; J. A. & C. H. McDonald, cut and carved stone work; C. Marega, modelling for stone and metal designs, also wood carving; Cornish & Cooper, bank fittings.



Union Bank of Canada Building, under construction at Vancouver, showing stone facing being put in place

The building will, it is anticipated, be completed, ready for occupancy, by the end of August, 1920. Including the elaborate bank fixtures, the total cost will be close to half a million dollars. Mr. Geo. S. Harrison, manager for the Union Bank in Vancouver, has devoted a great deal of time and attention to the working out of the many important preliminary matters in connection with the building. Much of the credit is due to him for the very perfect addition the new bank will make to the numerous examples of bank architecture in Vancouver.

With a frontage on Hastings Street of 104 feet, and on Seymour Street of 70 feet, the new building makes the third bank at those corners, the Molsons and Bank of Nova Scotia (formerly Bank of Ottawa) occupying two other corners. The location is one of the best in the city. It is one block from the Post Office and Customs Offices, and one block from the C. P. R. Depot and Terminals. Unlike some of the earlier blocks in Vancouver, the new Union Bank building is not of the skyscraper class. There are but two upper storeys, which will be arranged in suites of offices to be let.

Additions to London, Ont., Reservoir Capacity

After Consideration of All Types, Earth Embankment was Selected for New Basin as Being Cheaper and More in Keeping with the Surroundings—Floor is to be of Two Layer Concrete, Securely Waterproofed

By E. V. Buchanan*

On an accompanying map are shown the existing reservoir, the proposed immediate construction, and also future construction in connection with the waterworks system of the city of London, Ont. The present reservoir is a five-million gallon earthen embankment reservoir with puddled clay sides and bottom, and was constructed about forty years ago. When the construction of additional reservoir capacity was first decided upon, surveys were made of the topography of all available land in the vicinity of the existing reservoir, and the site, as shown on the plan, was finally chosen as the most suitable. Four types of reservoirs were considered, as follows:

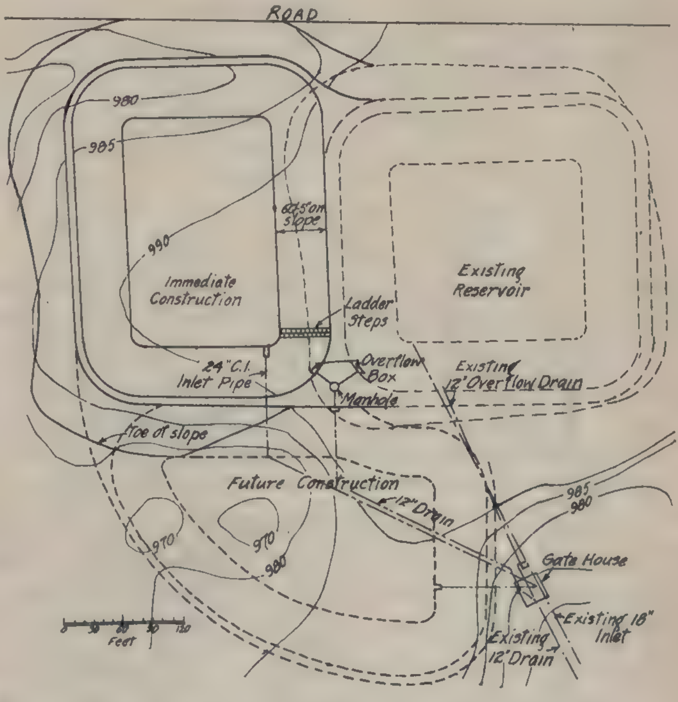
(1) Gravity concrete wall.
(2) Vertical reinforced concrete wall supported by buttresses.
(3) Inclined reinforced concrete slab supported by buttresses.
(4) Earthen embankment supporting concrete slabs.

Preliminary designs showed that the masonry gravity section would be more costly than reinforced concrete section and was, therefore, eliminated. As between the two types of reinforced concrete wall, the inclined slab, supported on buttresses, was found to give more economical structure, and a general design of a reservoir, using this type of construction, was prepared, as well as a general design using earthen embankment.

In the case of the earthen embankment type it was necessary to provide a much deeper reservoir than in the case of the inclined reinforced concrete slabs, in order to secure sufficient material to make the embankment, but in spite of this handicap, the cost of the earthen embankment type was found to be considerably cheaper and was, therefore, adopted.

In considering the two types of reservoirs, with reference to their location in the park now owned by the city, and which, on account of its natural beauty, is the rendezvous of thousands of citizens, we were also convinced that the reinforced concrete inclined slab type of construction, aside from its apparently greater cost, would be unsightly and would considerably detract from the surroundings. This will become apparent when it is recalled that no type of concrete structure can be successfully given a surface finish which will withstand changing weather conditions, without expending an undue amount upon it, and while this may be justified in the case of concrete bridges and similar structures, it could not be allowed in this case.

The type of reservoir adopted is particularly adapted to the site, in which the underlying material is a porous sand and gravel, and in order to make it watertight a two-layer floor of concrete, having an asphaltic waterproofing medium between the layers, is to be used. A four-inch slab, divided into fifteen-foot squares, will first be used; these slabs are to be reinforced with a light mesh reinforcement, the joints being filled with asphalt. A second layer of four-inch concrete similar to the first will be used, with the joints staggered above the first layer. Between the two layers of concrete will be placed three layers of strong fibre manilla burlap, which has been thoroughly saturated by immersion in a bath of heated asphalt. The burlap will be separated from each layer and from the concrete by a 1/16 in. layer of heated asphalt.



This map shows existing water reservoir, immediate extensions and future construction.

It is not anticipated that any trouble will be caused by frost action on account of the free draining character of the embankment. An ornamental iron fence, with close screening to protect the reservoir against animals and leaves will be placed on top of the concrete curb finishing the slope paving.

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*General manager, Public Utilities Commission, London, Ont.

The gate house is located at the corner common to the three reservoirs, and will consist of a concrete sub-structure, containing gates for controlling the flow into each of the basins, and with provision for draining the basins and overflow. It will be surmounted by an ornamental brick structure which will contain recording gauges giving the depth of the water in the various basins and stands for operating the gates.

The designs for this reservoir were prepared by Morris Knowles Limited, of Windsor, in conjunction with the engineering staff of the London Public Utilities Commission. The preliminary work on the reservoir has now commenced and it is the intention to carry out the greater part of the work by the Commission's own staff on the day labor principle, at an estimated cost of $100,000.

Effect of Car Tracks on Traffic Capacity of Roadways

By George W. Tillson*

THERE is probably no one thing that is the source of so much trouble and annoyance to the official in charge of the maintenance of street pavements or road surfaces as the existence of street car tracks in those surfaces. This is mainly true because he has no direct control over the repairs required to keep the tracks in good condition. As a general rule the street car companies must keep in good repair the tracks and pavements between same as well as for a short distance outside. It is generally provided also that, if the corporation does not do this, it may be done by the municipal authorities. But the procedure is such, and so much red tape is involved in carrying out the legal requirements, so that the cost of repairs may be collected from the company, that the provision is seldom resorted to and it is generally considered better policy to try and have the necessary work done by the corporation itself.

Location of Tracks

The principal items to be considered in this connection are the location of the track, their detailed construction, their degree of perfect maintenance, the character and amount of traffic on the tracks, and the character and amount of traffic on the street or road. The question of location is, perhaps, the one to be most considered, as upon the location depends the importance of the other items. Its discussion, too, involves the problem of what is the best location for car tracks when they must be laid within the lines of streets or roads. The common practice with streets is to place them in the centre, thus giving an opportunity for streams of traffic to move in either direction entirely independent of each other. With this arrangement it can easily be seen that the width between the cars and the curb will have much to do with the effect on traffic. In the Borough of Brooklyn, New York City, many streets with roadways only 34 ft. wide have two lines of car tracks: and some with a width of only 30 ft. In such cases the obstruction to traffic must be very great, as the distance from track to curb is only 9½ and 7½ ft. respectively and even these distances are reduced by the overhanging of the car itself. It is on streets like these that the items of construction maintenance, amount of traffic, etc., are particularly important.

Underground Trolley Makes Difficult Construction

The writer has always felt that a car track should be so constructed in a pavement that vehicular traffic could pass over it diagonally, squarely or in any direction without any real inconvenience, and that it should be so maintained that it would always meet this requirement. The heavy truck traffic that is so constantly increasing emphasizes this idea. With the present standard rails and latest construction there is no difficulty in meeting what is desired. Practically all electric roads in streets or highways are operated by overhead trolleys but in the Borough of Manhatten, New York City, where the underground trolley is used, it is necessary to have a slot half way between the rails of each track. This is also true of cable roads. Such construction makes it very difficult to properly maintain or lay the pavement. The space between the slot and rail is so narrow, and so shallow over the conduit that carries the power, that ordinary pavement methods are not successful. With the same amount of care in construction and maintenance, such tracks are more of an obstruction to traffic than those used with the overhead trolleys.

The Board of Estimate of the City of New York has made a rule that a double-track road shall not be laid in a street with a roadway of less than 40 ft. In Philadelphia, where the streets are narrow generally, but one track is laid in a roadway, the cars necessarily having different routes to and from the centre of the city.

In some cases where tracks are laid in the centre, an area is curbed especially for the tracks, vehicular crossings taking place only at cross streets or other especially provided places. This is true in a few other cities but, almost generally so in New Orleans. Here the streets as a rule are wide, allowing plenty of room for this method as well as for the general traffic of the city. In such cases, of course, traffic is not impeded at all except as to general crossing from one side of the street to the other.

Rochester, N. Y., has one or two streets where the tracks are located just inside the curb line. On one of the streets leading out of Paris the writer once saw a similar location. In Rochester the instance noted was on a distinctly residential street but in France it was in a small retail section.

With such a location the general street traffic would not be affected but it has always seemed to the writer that it must be very inconvenient to the people along the line, especially if it were on a business street. Here, however, again comes in the question of how much traffic the car lines carry and how often the cars run.

Example of Obstruction to Traffic

Perhaps the best example of obstruction to traffic by car tracks of which the writer has any cognizance is in the Borough of Manhattan, New York City. Central Park West is that portion of Eighth Avenue lying directly west of Central Park. This avenue south of 58th Street is 100 ft. wide with a 60-ft. roadway with car tracks in the centre. Central Park West is also 100 ft. wide but the roadway is only 48 ft. wide and the tracks are laid on the easterly side, the nearest rail being 3 ft. from the curb, leaving a free roadway of 29.9 ft., not taking into account the overhang of the car.

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*Presented at the annual convention of the National Highway Traffic Association.

Central Park West is built up on the west side with large apartment houses. The cross streets, too, are well built up so that the local traffic is heavy. Previous to the introduction of the automobile the obstruction to travel was not so great. But it can easily be seen that, with it being necessary for all pedestrians to cross two lines of vehicular traffic in order to take or leave a car, a great deal of trouble must occur. So many accidents occurred that in 1913 the Board of Estimate and Apportionment passed a resolution directing the railway company to relocate the eastery track at its own expense, with the intention of widening the roadway after this was done. It seems, however, that the tracks were located in their present position in 1897 at the request of the park commissioner of the city, and the corporation council advised that a court seeking to do equity might well deny the application to compel the company to again relocate its tracks entirely at its own expense. The estimated cost of the work was $352,000. Many communications passed between the city and the railway company in regard to the matter but no physical work was ever done and the tracks and roadway still remain as herein described. The police reports show that on this street 286 accidents occurred during the years 1910 to 1913 inclusive. In addition to the accidents to persons, the police records show that in 1913 there were 36 collisions between vehicles and eight collisions between vehicles and surface cars. It is also stated that probably only the most serious vehicle collisions are included in the police records. No doubt the number of accidents have increased in subsequent years. In any event, recently Central Park West has been made a one way street so as to reduce the number of accidents to a minimum. In order to understand just what this means it must be remembered that Ceneral Park extends in width from 5th Avenue to 8th Avenue, a distance of half a mile, and that by making Central Park a street for south bound traffic only, this distance is increased by one long block so that all north bound traffic is cut off between 5th and Columbus (old 9th) Avenues. This, of course, increases the congestion on all north and south avenues. North bound automobile pleasure traffic, although permitted to go through Central Park, has but two outlets to the west, so that if not through traffic it must be seriously inconvenienced.

Compare for a moment the situation on Fifth Avenue south of 59th Street. This street is also 100 ft. wide and prior to 1908 had a roadway of 40 ft. with sidewalk spaces 30 ft. wide, but areas and stoops were allowed to encroach 15 ft. so that the free width of the street was only 70 ft. The Board of Estimate and Apportionment by resolution widened the roadway by setting the curb back 7½ ft. on each side and ordered the encroachments back to within 2½ ft. from the property line, thus giving a roadway 55 ft. in width with sidewalks 20 ft. wide free from obstruction. The old roadway permitted four lines of traffic while the additional 15 ft. in width furnished space for two more and even this is insufficient for the traffic requirements.

The large cars of the Brooklyn Rapid Transit Co. when passing occupy practically 19 ft. of space,—18.6 ft. to be exact. Supposing a double track line were laid in the centre of 5th Avenue; with the traffic it would certainly have, when two cars met there would be left on each side a distance of 18 ft. only, sufficient only for two lines of travel; in other words, nearly all of the benefits of the widening would be lost.

Prospect Park, Brooklyn, has five sides and on all of the adjacent streets there are street car tracks. With one exception the location is similar to that on Central Park West. But on only one street, Prospect Park West, has it been necessary to establish one way traffic. This is because both the local street car, passenger and also vehicular traffic are light. During the summer a large part of passengers carried by the car lines have the park itself as an objective and they, of course, are benefitted by having the tracks adjacent to the curb. The situation as a whole, however, well illustrates the bearing of both kinds of traffic upon the subject under consideration.

Tracks Increase Repair Bills

In another, but perhaps indirect, way can be shown somewhat how traffic is diverted on street car streets, and that is by its effect upon the pavements.

In the Borough of Brooklyn careful records have been kept of the cost of repairs to all pavements for more than 15 years, by individual streets.

The cost of repairs to asphalt pavements on streets without car tracks for the years 1914 to 1918 inclusive has averaged 2c. per square yard; and with street car tracks the cost has been 3.4c. While these figures prove nothing directly they are at least indicative as they give results upon 31,645,000 and 3,884,000 square yards of pavement on streets without and with car tracks, respectively.

Location on Roads

The problem of track location on roads is somewhat different from that on streets as the local conditions are so different. Then too, a country road, even if paved, seldom has its pavement of greater width than will accommodate expected vehicular traffic, so that any interference with existing pavement will be serious. Fortunately, however, there are generally no very serious objections to a side location, the tracks being sufficiently far apart to provide for ample width of the pavement between them. The new National Highway bill proposes where feasible, a 66-ft. width of right of way and a pavement width of not less than 20 ft. This would give ample room for car tracks on both sides of the pavement. Whenever a wider roadway is required or any special local conditions arise, each case must be considered on its individual merits.

If the tracks are located in the pavement, whether in a city street or country road, the shape of rail and method of construction become very important. As has been previously stated, the mere existence of tracks in a pavement should not interfere with traffic. As a matter of fact, they do. The writer some 25 years ago saw a track on 14th St., Borough of Manhattan, laid with two centre bearing rails instead of one laid on longitudinal wooden stringers, the rails and tracks being so near and of such construction that traffic in the centre of the street was almost entirely cut off. Fortunately, such conditions do not now exist anywhere but they illustrate the importance of the principle.

No doubt the well known tee rail of the steam roads is the most economical type of rail for traffic. It does not, however, permit a smooth junction between the pavement and the rail, either between the tracks or outside. This type of rail also is liable to cause ruts alongside the rail if the tracks are much used by vehicles. With the present grooved rail in use in most cities, with a practically square edge on the outside and the flat lip on the inside, it is perfectly practicable to construct a track that per se will not interfere with traffic, especially if a 60-ft. rail be used. Specially burned brick or specially cut stone blocks are sometimes used in connection with the tee rail, the groove being really cut out of the blocks. This method often produces good results. On a country road where the tracks are laid outside of the pavement, the tee rail can, of course, be used to advantage.

Track and Pavement in Good Condition

But whatever the style of construction, it should be designed with the idea of keeping both the track and pavement in good condition. Unfortunately, the track area of pavements in American city streets are not generally in good condition. Much improvement, however, has taken place during the last 20 years and most street railway companies realize that it is good policy to keep their plant well maintained. Again, unfortunately, soon after this realization, the world war came on, bringing with it financial changes to all, but which seemed to injure street car companies more than almost any corporations, bound as the most of them are by franchise obligations as to permissible fares, with costs of labor and materials mounting up with aeroplane-like rapidity.

If, then, car tracks are to exist in paved streets or roadways, they should be so constructed as to present as little interference as possible with the pavement.

Perhaps the most important item in construction is the type of rail to be used and this has previously been discussed.

The road bed and foundation, too, must be specially prepared. The rail must not give appreciably under car traffic as it is almost impossible to maintain any pavement against a rail that moves vertically under the passage of cars.

The joints too are a prolific source of trouble. Many times a hole in a pavement along the track has its origin at a defective joint. The use in the last few years of a 60-ft. rail has helped this situation very much.

Admitting the force of the arguments used herein, it follows that street car tracks do obstruct traffic very materially when in use in streets or roadways. Also that the extent of this obstruction depends upon the amount of existing traffic and location of tracks, being greatest where both tracks and roadway are used to their outmost capacity and the tracks laid in the pavement, and almost nil where traffic is light and the tracks located outside of the pavement proper. Probably no better illustration of the relative traffic capacity of street car and non-street car streets can be given than existing conditions on Jackson Boulevard and either Adams or Madison streets in the Chicago loop district in the rush hours.

Study Traffic Intensity

In designing, then, a street or road where provision must be made for street car lines, a study must be made of both street car and vehicular traffic, present and prospective, so that the relative importance of each may be determined. As a general proposition the centre of a paved street will be the correct location, but often special conditions may make a different one desirable. In the same way it might be said that on a country road the side location would be most logical, changing somewhat, possibly, when passing through small towns or villages.

Wherever the location the type of construction should be good, variations being permitted according to exact location and character and amount of traffic.

As careful provision should be made for the maintenance of the tracks and pavement to be kept in repair by the street car company, if any, as for the roadway pavement itself. The writer knows that this is often difficult but thinks that unless the company is operating under a franchise giving it special privileges, good results can be obtained by some arrangement. If a new franchise is to be issued, the car company might be obligated to pay a specified amount with the understanding that the highway authorities would keep the pavement in repair. The maintenance of the tracks and road must be left to the operating company.

The writer feels, therefore, that if these precautions are taken, that while some traffic obstruction must exist, it will in this way be reduced to a minimum and the general travelling public will be benefitted as much as possible.

New Hollow Concrete Brick Introduced in England

A new building unit that has recently been introduced in England, says Commerce Reports, is nearly five times as large as an ordinary brick, but in comparison is much less heavy and is easily handled. The lighter weight results from the hollowing out of the brick to provide air layers. By the shaping of the ends the existence of joints running all the way through a wall is avoided. The brick is, as a rule, made of 1 part cement and 4 parts sand by simple hand machinery. Three men can make enough bricks in a day to build 400 to 500 sq. ft. of wall. A further economy is effected by the manner of laying the walls, inasmuch as the ends and bottoms of the bricks need only to be dipped in a thin lime mortar mixed with a small amount of cement. If laid in the usual way the air channels in the brick would become filled. It may be added that slag, clinker, sand, and brick dust, mixed with cement, form suitable materials for these bricks.

British Industrial Art Exhibition

The British Industrial Art Exhibition will open on 16th September, at Knightsbridge, London. This exhibition comprises textiles, wall papers, furniture, pottery, glass and metal work, also building and other crafts. A number of buyers are expected at the exhibition from Canada and the other overseas Dominions, also foreign countries.

Canadian buyers who propose to visit the exhibition should secure further information from the nearest British Trade Commissioner in Canada. Their names and addresses are: (a) Captain E. J. Edwards, 248 St. James St., Montreal; (b) F. W. Field, 260 Confederation Life Bldg., Toronto; (c) L. B. Beale, 610 Electric Railway Chambers, Winnipeg.

The Merits of Asphaltic Concrete Pavements

These Have Proven Economical to Build and Maintain—Macadam and Gravel Roads Form Excellent Foundations

By W. H. Connell*

NINE-TENTHS of the highway problem to my mind has always been the upkeep. The "stitch in time saves nine" maxim is really the whole problem, after the location of the road has been selected and provision made for drainage. Location comes first, and drainage comes second of course. After provision has been made for those two fundamentals, then the question is what kind of road is the one that should be built in this particular locality. That depends upon traffic, social and local conditions. It would be perfect nonsense and waste of money to put down asphaltic concrete, or sheet asphalt in a location where there will not be enough traffic for that kind of pavement in a great many years. One must start at the bottom and build up gradually. First, the earth road, then the gravel road, then macadam roads, then macadam roads, surface treated. Then comes penetration roads, bituminous or asphaltic concrete on a macadam foundation, and sheet asphalt on a concrete foundation, then comes the concrete, then the brick and last but not least, the granite pavement.

Macadam Stands Up if Given Attention

I have heard a great many engineers in different localities say that the day of macadam has gone by, that macadam will not stand up under present day traffic in localities where there is considerable motor traffic. It will stand up, and almost indefinitely under automobile traffic, if given surface treatments as frequently as are required. Surface treatments should be applied to macadam roads under some conditions every year, and under other conditions every two years or three years, depending on the amount of traffic. I recently went over a number of roads in Pennsylvania where there are a great many good roads of all descriptions with a number of engineers, and they said "we have come to the conclusion that we are going to lay off these roads and let them all go, all gravel and macadam, until we can afford to put down one of the more or less permanent types of pavement." That policy will result in an unwarranted waste of money. We have proved rightly in New York city and some of the heaviest travelled roads in Philadelphia that one can take an ordinary broken stone road and keep it almost indefinitely at a very modest cost, if it is given constant attention. Keep the surface treatment on it. Patch the road, and give it the day-to-day attention that anything else in the world requires if it is to be kept up, and the road will give first class service, until the time when it is going to be turned over to very heavy motor truck traffic.

Carries 10,000 Autos a Day

I resurfaced a macadam road in New York City, the Grand Boulevard and concourse, the main highway leading out from the Bronx to Boston, with from ten to twelve thousand automobiles a day travelling over it. It was built in 1910. We did not have any pressure means for putting down our surfacing material, but used the old crude method of the watering can. It was macadam surfaced with tar. That road has been kept up and treated as often as required and is in perfect condition today, and was when I saw it a few weeks ago. That is an illustration of what can be done with materials at hand. If you take the materials at hand in this part of the country, and follow out the principles laid down by Mr. Hirst and some of the other speakers who have dealt with the problem of handling earth and gravel roads, and you can build up a road system here that will be adequate for the traffic you have. If that road is located right, and the drainage is properly taken care of, all the money you put in the roadbed today is going to be returned to you a hundredfold when the time comes to lay the asphaltic concrete or the concrete road on top of it, for the main thing is to have a sub-base that will hold the traffic.

The great trouble we are having today is that we lay a six-inch concrete road on a new sub-base, where there has been no road before. Concrete will not crush under traffic. In New York city about two years ago they made an investigation at my request to find out if the concrete did crush under the heaviest traffic they had in the city, and they found that it never did crush or give under traffic. A great many say that six inches of concrete will not stand very heavy motor traffic. They miss the point. The concrete stands, but the sub-base under the concrete goes with the traffic and that breaks the concrete. If you build your road, and it is desirable to put a road in certain locations, build it up on materials that you have at hand, and let the traffic keep going over it for years and when the time comes to put on your concrete, you will have a perfectly firm and solid sub-base that will enable you to keep your road under the heaviest possible traffic, because four or five inches of concrete will stand up if the sub-base is sufficiently solid.

The building of roads is like any other business problem. When you start in business, you don't start in at the top. You organize the company, usually in a small way, and then gradually build up, until you get a big corporation. The same thing applies to the road. You have to creep before you walk, and it is the pioneer work that makes it possible to get the good road system later on. You must not be discouraged because you cannot lay one of the modern, more or less permanent, types of pavement. It would not be the thing to do; the financial outlay would be too great for the amount of traffic that these roads will require to carry. This whole thing must be viewed from the purely cold-blooded business standpoint. You must realize that the road that you are going to build here should be the one that you are justified in building in the locality for the amount of traffic existing there. Of course, once you build roads you are going to attract traffic, and it will gradually become heavier. Then, there will gradually be a change in the type of pavement, until you get to the more or less permanent type.

The time has come to my way of thinking, when, between the big cities we shall have to have two types of roads, one for ordinary passenger automobiles, and one for motor trucks. I do not believe that we as roadbuilders should strive for legislation limiting the weight of trucks, but we should have legislation limiting the weight of trucks per inch of width of tire. The trucks carry our produce, and no matter how we try to limit their weight, they are going to grow in size as big as they can grow, for two to pass, one going in one direction and the other in the opposite direction. So our problem is to build roads, where the motor truck traffic is heavy between cities, that will carry the greatest amount of weight that there can be put on a truck of reasonable size, keeping in mind always that the width of tire must conform to the weight on the truck. I was asked by the Manufacturers' Association of Baltimore, several months ago, to say something on that subject, and I told them that the time was coming, and I firmly believe it is, when we shall have steel tracks for our heavy motor truck traffic, paved with granite block in between, and on the shoulder, to carry the large trucks between such cities as New York, Philadelphia, Baltimore and Washington. We cannot build a road to carry the kind of traffic that passes through a park that will also carry the kind of traffic expected over an inter-city freight motor truck road. It would be a waste of money to build a road for such heavy motor truck traffic, where probably 80 per cent. of the traffic is passenger automobile traffic. We should be building a very expensive type of road to carry the 20 per cent. traffic, one that would be entirely unnecessary for the 80 per cent. That problem is already confronting us, and it is not going to be long before it is going to confront you here in Canada, in Quebec, Montreal, Hamilton, Toronto and other thickly populated districts.

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*Consulting engineer, Philadelphia, Pa., before 7th Canadian Good Roads Congress.

In Manitoba your problem is largely one of earth and gravel roads. Several years ago, I had the pleasure of attending the first convention of this association held in Montreal, and road-building at that time was very new in that part of the country. They were then building the King Edward highway, an ordinary water-bound macadam road, and had completed fifteen or twenty miles of it. They have made tremendous strides since that time, so that their problem is now the same as ours, and they are building more or less permanent types of road. In this part of the country you will make the strides they have made in the more populated centres, and will later be building more or less permanent types of road.

There are two ways of building asphalt roads, namely, on a macadam foundation or on a concrete foundation. If you build your roads now, on a proper location, and with proper drainage and plenty of outlets, and when gravel is required you put it on, then when the time comes to put on an asphaltic concrete, you will have a foundation that you can lay the road on, provided it is a travelled road. I believe that if you put the asphaltic concrete road on a broken stone foundation, or on a gravel foundation that has been travelled over, so that it is thoroughly compact, you really get better results than if you put it on concrete. Concrete will crack. We cannot stop it from cracking, and the pavement will crack right through to the surface. That, of course, does not injure the pavement seriously. You can bind up those cracks with a little bituminous material, but you are not likely to have that trouble on an old macadam or gravel road.

Kinds of Asphaltic Concrete Pavement

An asphaltic concrete that we have built successfully, is the one that is covered by the Warren patent, and that is about 7½ per cent. of asphalt, 8 to 10 per cent. of limestone or portland cement dust, 50 to 55 or 60 per cent. of stone and 25 to 30 per cent. of sand, all properly graded. I have laid several hundred miles of that type of pavement, but laid it in the locations where the patent did not affect us, and we were not disturbed. That is the best asphaltic concrete pavement. The second is that known as the Topeka pavement. In that you put a moderate percentage of asphalt, about 8 or 9 per cent., because you use a small-size stone, about a quarter of an inch, and you also use a different grade of sand. We have had very satisfactory results with it. In an inspection tour I made recently, I particularly noted the results of the wear of heavy truck travel over the various types of pavement. The asphaltic concrete has stood up as well as any one of the types of pavement I speak of, and has given the service that we expected it to give, and in any classification of pavements I put it ahead of concrete, that is if it is on an old broken stone road or on a concrete base.

This statement would probably be disputed by a great many people, because concrete seems to the layman better than anything else, because he does not know anything about it except in a superficial way. The simplest thing to a layman's mind is concrete. Concrete roads are good roads, but you cannot build them that they won't crack. If you can do that, there are untold millions waiting for you. A concrete road after it is laid must be maintained like any other road, and it is usually maintained by being patched and chequered with tar and asphalt poured into the joints, resulting in a very ugly looking pavement, to my mind not a fit one for a park or a city. The asphaltic concrete pavements on a firm base will give just as good wear as a concrete road and is a very pleasant type of pavement to look at. It harmonizes with the surroundings. You do not have those ugly cracks staggering all over the road and staring you in the face, and you have a road that is very desirable for automobile traffic, not too slippery for horse-drawn traffic and one that, as I said before, will last and give you the service, as has been proved.

Asphaltic Concrete Economical for Ordinary Traffic

In our part of the country, we have kept very close watch on paving costs, and, judging from our experience, the roads that stand out as the most economical for ordinary traffic, not for the very heavy motor truck traffic that exists between cities on some roads, but for roads accommodating from ten to sixteen thousand automobiles a day, mostly passenger cars and a few motor trucks, those that are the most economical to build and maintain are of asphaltic concrete. The concrete truck road gives service and does not require very extensive repairs, but it costs much more to build it, and it does not prove to be so economical as the other type.

I was asked to say a word or two about the service test road built in Philadelphia in 1912, consisting of twenty-eight different types of construction. This was very conscientiously maintained until the United States got into the war. One section was asphaltic concrete laid cold, that is an asphalt cut back and mixed in the plant and then hauled out to the road, laid cold and rolled. It is a very satisfactory type of road for ordinary park motor traffic, but it is not so good as the hot asphaltic concrete and will not stand heavy motor traffic. A number of different types were put on this road without considering whether they were types of pavement suitable for the particular traffic existing there, and in analyzing the results obtained, if one style of pavement did not last in that section of road in which it was laid, it should not be condemned. They were analyzed according to the traffic they will stand. The roads that stood up the best were of brick. They are there today, and have not had one cent of repair, but they cost twice as much to construct as the concrete and asphaltic concrete. One section of the asphaltic concrete, coming under the specification I have just noted, of 55-60% of stone passing through a 1½ in. or 1¼ in. grade and 7½ per cent. of asphalt, has not had any repair. Another section of the road, with the same specification, had only cost two cents a yard, on an average to maintain for seven years. The pavement laid with the smaller stone, the so-called Topeka pavement, has cost only five or six cents a yard to maintain for the same period of years. All the pavements stood up with practically no repairs until the fall of 1917. Up to that time the traffic was the ordinary motor truck traffic with a larger percentage of passenger cars. When we got very active in the war, that particular road was part of the Lincoln Highway and was the main motor truck road to New York and Philadelphia. There were then streams of motor trucks passing over it day after day. And when that started, all the sections laid by the penetration method failed. The traffic was too heavy for them. They were not intended for the heavy pounding of motor trucks. As I say, up to 1917, when this extraordinary motor traffic began all the different types of pavement stood up well, including the macadam with surface treatment, but when the motor truck traffic came on the only ones that stood up were the bricks, the asphaltic concrete and the concrete.

New Ideas Applied to Cement Concrete Roads

Researches on the Subject of Consistency Shed New Light on Improvement of Concrete Pavements—Paper Read at Canadian Good Roads Congress

By W. P. Near, M.E.I.C.*

PERHAPS in no other type of road construction has there been such marked improvement in methods of construction and in standardizing of specifications as has been accomplished with the cement concrete road during the last ten years. It had been advertised that mixing and placing of concrete was the work of an unskilled workman, but the experiments of these years have proven that the intelligence of skilled workmen and trained foremen and engineers is needed and pays for itself in results attained. During this ten-year period concrete roads have grown in popularity, as shown by the fact that in 1909 they had been laid in only one province, Ontario, and to the extent of 72,000 sq. yds., while at the end of the year 1919 concrete roads had been constructed in every province in Canada to the total of 3,970,459 square yds. In the United States during the year 1919 there were constructed 53,459,934 sq. yds., making a total yardage at the end of 1919 of 167,015,086 sq. yds. In the presence of these figures it is not my intention to use this paper to describe concrete roads or methods of construction as they have been standardized. But with all of our experience there always remain some features of specifications and construction methods which require to be kept constantly before us if we are to secure best results. I will attempt to bring out a few of these features and, in doing so, lay no claim to any originality for the suggestions made.

Preparation of Sub-Grade

It has been usual to bring the sub-grade to proper contour. leaving same a little high to allow for rolling and then to consolidate by rolling and re-rolling with a heavy steam roller, filling up the depressions and re-rolling until the entire sub-grade is consolidated. Now many engineers contend that the sub-grade should receive little or no rolling. Particularly is this true for heavy clay and gumbo soils. They recommend that the sub-grade should be brought to within one or two inches of the desired elevation, the side forms should then be accurately set and the remaining portions of the sub-grade carefully scraped or honed to desired contour.

On clay and gumbo soils which shrink and swell excessively with variations between dry and moist conditions, it is recommended that a layer, three or four inches in thickness, of cinders or fine gravel be placed upon the sub-grade before the concrete is laid.

Where the usual methods of plowing and rolling are adopted for preparation of sub-grade it is recommended that the plowing should extend ten or twelve inches below sub-grade, the surplus material then is excavated and removed and the sub-grade consolidated. This will produce a sub-grade of a more uniform bearing capacity than that secured by attempting to plow only as deep as the finished sub-grade. It is also claimed for this method that it is economical from the contractor's point of view in that the materials are more easily excavated as a result of the deep plowing.

Care of Sub-Grade Before Placing on Concrete

So often it happens that the sub-grade is prepared in a perfectly satisfactory manner, and while materials for the concrete are being hauled and distributed a few days will cause the sub-grade for long stretches to be rutted and cut up and the previous preparation to be destroyed. Then the sand and stone become mixed with the grade, much of it is lost and the quality of the remainder is very much lowered. The remedy for this is in the central mixing plant and the industrial railroad and such good results to the concrete can be secured as well as economies in the handling of materials that I think the day is coming when specifications will require that when the sub-grade is once prepared, all driving and traffic over such sub-grade shall be prohibited until the concrete is placed.

The idea of a central mixing plant is not necessarily confined to a large contractor's plant. Small units with half mile to a mile of track necessitating the moving of the central plant as each half mile or mile, as the case may be, of road is completed should be quite feasible and, with proper organization, should prove economical. After each shift of the central plant the sub-grade may be given its final preparation with no further fear of disturbance until the concrete is placed.

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*City engineer, St. Catharines, Ont.

Consistency

One of the commonest of bad practices amongst concrete construction plants, especially of small or moderate sizes is that of using too much water in the batch. Larger construction units with mechanical tamping and finishing devices are not so prone to make this mistake. It used to be assumed that enough water to make the cement set was necessary to make concrete and more did not hurt any. The men handling the mixed concrete, especially from a mixer employing a chute encourage the use of excess water because it makes handling easier for them and the operators of the template or strike board are usually fond of a sloppy mix. In this regard the investigations of Professor D. A. Abrams, of the Structural Materials Research Laboratory, Lewis Institute, Chicago, have shown conclusively that the strength of concrete depends upon the ratio of the amount of water to the amount of cement, and that the use of more water than is necessary to produce a workable consistency is not only wasting cement but is producing a concrete from one-third to one-hafl the normal strength. It is also established that compressive strength of concrete is a direct measure of its wearing quality so that the possibility of reducing the wearing qualities of a road by too liberal a supply of water in the mixing may assume tremendous possibilities.

A test for consistency which may readily be made on the work, has been devised by the Illinois State Highway Department, and is known as the slump test using a truncated cone. The method of making the test consists of filling a thin metal mold in the form of a truncated cone having an 8-in. base, 4-in. top and 12-ins. high, with the freshly mixed concrete, which is lightly tamped by a rod as the concrete is placed in the mold. As soon as the mold is filled and struck with a trowel it is removed by means of handles and the height of the concrete after removal of the mold is measured. The difference between this height and the height of the mold is taken as the measure of the slump. For concrete pavement the slump for a workable consistency lies between ½ inch and 1½ inch, depending respectively on whether mechanical tamping and finishing is used or whether the template is worked by hand. When the proper consistency of the batch has been determined by this means the appearance of the concrete is noted and used as a guide for future batches with only occasional slump tests being necessary. When it is proven that 10 to 15 per cent. excess water has cut down the strength of the concrete nearly 50 per cent. it must be realized that too much importance cannot be attached to the question of consistency.

SIZES		FINE AGGREGATES, SCREEN OPENINGS PER INCH														
COARSE AGGREGATES Inches	Cement in Barrels Aggregates in Cubic Yards	0-28			0-14			0-8			0-4			0-⅜ in.		
		Cement	Fine	Coarse	Cement	Fine	Coarse	Cement	Fine	Coarse	Cement	Fine	Coarse	Cement	Fine	Coarse
No. 4 Screen to ¾	Proportions	1	1.3	2.4	1	1.6	2.4	1	1.8	2.3	1	2.0	2.3	1	2.7	1.5
	Quantities	1.96	.37	[illegible]	1.85	.44	.66	1.82	.48	.62	1.75	.52	.59	1.79	.72	.40
No. 4 Screen to 1	Proportions	1	1.3	2.7	1	1.6	2.6	1	1.8	2.6	1	2.0	2.5	1	2.6	1.8
	Quantities	1.90	.36	.76	1.77	.42	.68	1.72	.46	.66	1.67	.50	.62	1.72	.66	.46
No. 4 Screen to 1½	Proportions	1	1.2	3.1	1	1.6	3.2	1	1.7	3.1	1	2	3	1	2.4	2.4
	Quantities	1.82	.32	.84	1.68	.40	.79	1.63	.41	.75	1.61	.47	.72	1.62	.57	.57
No. 4 Screen to 2	Proportions	1	1.2	3.5	1	1.5	3.5	1	1.6	3.7	1	1.9	3.6	1	2.2	3.1
	Quantities	1.75	.31	.90	1.63	.36	.85	1.55	.36	.85	1.52	.43	.81	1.53	.50	.70
No. 4 Screen to 2½	Proportions	1	1.1	3.8	1	1.4	3.9	1	1.6	4.0	1	1.8	4.0	1	2.1	3.5
	Quantities	1.72	.28	.97	1.58	.33	.91	1.51	.35	.89	1.49	.40	.88	1.50	.46	.78
No. 4 Screen to 3	Proportions	1	1.1	3.9	1	1.4	4.1	1	1.5	4.1	1	1.7	4.1	1	2.0	3.7
	Quantities	1.69	.28	.97	1.58	.33	.97	1.49	.33	.90	1.49	.37	.90	1.49	.44	.81
⅜ to ¾	Proportions	1	1.3	2.3	1	1.7	2.3	1	1.9	2.3	1	2.2	2.2	1	2.8	1.4
	Quantities	1.96	.37	.67	1.85	.46	.63	1.82	.51	.62	1.75	.57	.57	1.79	.75	.37
⅜ to 1	Proportions	1	1.3	2.6	1	1.7	2.6	1	1.9	2.5	1	2.2	2.4	1	2.7	1.7
	Quantities	1.90	.36	.74	1.77	.44	.68	1.72	.48	.64	1.67	.54	.59	1.72	.68	.43
⅜ to 1½	Proportions	1	1.3	3.0	1	1.7	3.0	1	1.9	3.0	1	2.1	2.9	1	2.6	2.2
	Quantities	1.82	.35	.80	1.68	.43	.75	1.63	.46	.73	1.61	.50	.68	1.62	.63	.53
⅜ to 2	Proportions	1	1.3	3.3	1	1.7	3.4	1	1.8	3.5	1	2.0	3.4	1	2.4	2.9
	Quantities	1.75	.34	86	1.63	.41	.83	1.55	.42	.80	1.52	.45	.77	1.53	.62	.66
⅜ to 2½	Proportions	1	1.3	3.7	1	1.6	3.7	1	1.7	3.9	1	2.0	3.8	1	2.3	3.3
	Quantities	1.72	.33	.95	1.58	.37	.87	1.51	.37	.87	1.49	.44	.84	1.50	.51	.74
⅜ to 3	Proportions	1	1.2	3.8	1	1.6	3.9	1	1.7	4.0	1	1.9	4.0	1	2.2	3.5
	Quantities	1.68	.30	.95	1.58	.37	.91	1.49	.37	[illegible]	1.49	.42	.88	1.49	.48	.77
½ to ¾	Proportions	1	1.5	2.3	1	1.9	2.2	1	2.1	2.2	1	2.3	2.1	1	2.8	1.3
	Quantities	1.96	.44	.67	1.85	.52	.61	1.82	.56	.59	1.75	.59	.54	1.79	.75	.34
½ to 1	Proportions	1	1.5	2.5	1	1.9	2.5	1	2.1	2.4	1	2.3	2.4	1	2.8	1.6
	Quantities	1.90	.42	.70	1.77	.50	.68	1.72	.53	.61	1.67	.57	.59	1.72	.72	.41

SIZES		FINE AGGREGATES, SCREEN OPENINGS PER INCH														
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		Cement	Fine	Coarse	Cement	Fine	Coarse	Cement	Fine	Coarse	Cement	Fine	Coarse	Cement	Fine	Coarse
½ to 1½	Proportions	1	1.4	2.8	1	1.9	2.9	1	2.1	2.9	1	2.2	2.8	1	2.7	2.1
	Quantities	1.82	37	.75	1.68	.47	.73	1.63	.51	.69	1.61	.52	.65	1.62	.65	.51
½ to 2	Proportions	1	1.4	3.3	1	1.9	3.3	1	2.0	3.4	1	2.2	3.3	1	2.7	2.7
	Quantities	1.75	.36	.86	1.63	.46	.79	1.55	.46	.78	1.52	.50	.74	1.53	.62	.62
½ to 2½	Proportions	1	1.4	3.6	1	1.8	3.6	1	1.9	3.7	1	2.1	3.7	1	2.6	3.1
	Quantities	1.72	.35	.91	1.58	.43	.85	1.51	.42	[illegible]	1.49	.46	[illegible]	1.50	.57	[illegible]
½ to 3	Proportions	1	1.3	3.7	1	1.8	3.8	1	1.8	3.9	1	2.1	4.0	1	2.4	3.3
	Quantities	1.68	.33	.92	1.58	.42	.89	1.49	.40	[illegible]	1.49	.46	[illegible]	1.49	.53	[illegible]
¾ to 1	Proportions	1	1.7	2.4	1	2.1	2.4	1	2.4	2.1	1	2.6	2.2	1	3.1	1.5
	Quantities	1.90	.48	.68	1.77	.55	.63	1.72	.61	.53	1.67	.64	.55	1.72	.79	.39
¾ to 1½	Proportions	1	1.7	2.7	1	2.0	2.8	1	2.3	2.7	1	2.5	2.7	1	3.0	2.0
	Quantities	1.82	.46	.73	1.79	.50	.70	1.63	.55	.65	1.61	.59	.64	1.62	.73	[illegible]
¾ to 2	Proportions	1	1.7	3.1	1	2.0	3.1	1	2.3	3.1	1	2.5	3.0	1	3.0	2.4
	Quantities	1.75	.44	.80	1.63	.48	.75	1.55	.53	.72	1 52	.56	.67	1.53	.68	.55
¾ to 2½	Proportions	1	1.7	3.3	1	2.0	3.5	1	2.3	3.4	1	2.4	3.4	1	2.9	2.8
	Quantities	1.72	.43	.84	1.63	.47	[illegible]	1.51	.52	.76	1.49	.53	.75	1.50	.64	.62
¾ to 3	Proportions	1	1.7	3.5	1	2.0	3.7	1	2.3	3.7	1	2.4	3.8	1	2.8	3.1
	Quantities	1.68	.43	88	1.58	.47	.87	1.49	.51	.81	1.49	.53	.79	1 49	[illegible]	[illegible]
1 to 1½	Proportions	1	1.7	2.8	1	2.0	2.9	1	2.3	2.7	1	2.6	2.6	1	3.1	2.0
	Quantities	1.82	.46	.75	1.68	.50	.73	1.63	.55	.65	1.61	.62	.62	1 62	.75	48
1 to 2	Proportions	1	1.5	3.2	1	1.9	3.5	1	2.2	3.3	1	2.4	3.3	1	3.0	2.6
	Quantities	1.75	.39	[illegible]	1.63	.48	.85	1.58	.51	.76	1.52	.54	74	1 53	68	[illegible]
1 to 2½	Proportions	1	1.4	3.4	1	1.9	[illegible]	1	2.0	3.7	1	2.3	3.7	1	2.7	3.1
	Quantities	1.72	.35	.86	1.58	.45	[illegible]	1.51	.44	[illegible]	1.49	.51	[illegible]	1.50	[illegible]	[illegible]
1 to 3	Proportions	1	1.3	3.6	1	1.8	4.0	1	2.0	3.9	1	2.2	3.9	1	2.7	3.3
	Quantities	1.67	.33	.90	1 58	.42	.94	1.49	.44	[illegible]	1.49	.48	86	1.49	[illegible]	.71

Abrams' table of proportions and quantities for one cubic yard of concrete, based on laboratory investigations, using approved materials, compressive strength at 28 days with workable plasticity, 6 by 12 in. cylinders being 3,000 lbs. per sq. in.

Specification for Consistency

The amount of water to be used for mixing concrete shall be that which will give a consistency to be determined as follows:

Newly mixed concrete shall be placed in a truncated cone-shaped metal mold having an 8-in. base, 4-in. top and 12 ins. high. The concrete shall be lightly tamped with a rod as it is placed in the mold, which, when filled, is to be immediately removed by means of handles on either side of the mold and the slump or settlement of the concrete noted. For concrete to be finished by a mechanical tamping machine the slump shall not be less than ½ in. nor exceed 1 in. If the concrete is to be finished by hand methods the slump may be as much as 1½ ins.

Proportioning

Our specifications for proportions are fairly fixed at 1: 2: 3 or thereabouts and the grading of the fine aggregate from fine to ¼ in. is defined and the grading of the coarse aggregate from ¼ in. to 1½ in. is specified. But assuming that the road is being built in a locality where materials up to these standards are possible, yet it is common experience that the sands from the pits and the stone from the crusher vary from day to day, and many of us have attempted by methods of screening samples and by personal observation to change the proportion of sand to allow for an excess of fine material in the coarse aggregate or to increase the proportion of cement when materials come too fine for specifications. Usually these changed proportions are met by objections from the contractor although the same contractor is most anxious to keep his plant going by using the materials as they come to hand without regard often to the suitability of the grading of the aggregates. Here again the investigations of Prof. Abrams are proving themselves valuable. From a very large range of tests and experiments Prof. Abrams has established that a wide range of proportions of fine and coarse aggregates of various gradings may be combined with the proper ratio of cement and water to give a concrete of the same strength as the model or specification mixture. Thus it is possible and practicable to make concrete of equal strength of quite dissimilarly graded aggregates. For example, one aggregate may range from 3-in. pieces to the finer sand particles, while the second may contain no pieces over 1-in. in size. Yet by varying the proportions of cement each of these aggregates may be used and the strength of the resulting concrete be the same in each instance. This result is of far-reaching importance as it enables the use of a wide variation of materials without sacrificing the quality desired. It results in standardizing the product instead of the specification.

From sieve analysis Prof. Abrams has evolved a property of aggregates which he calls the fineness modulus, which he defines as being such a property of the aggregates that two aggregates within reasonable limits of grading with the same fineness modulus will, if mixed with the same amount of cement and water, produce a concrete of similar plasticity and of a similar strength in a given time.

Table Showing Proportions

Now, instead of making a rough screen analysis in the field or judging the visible properties of the mixed concrete to decide on changes in proportions to take care of the variations in aggregates received we have tables prepared by Prof. Abrams, showing a wide range of proportions of fine and coarse aggregates which, mixed with the proper proportion of cement, and mixed to the correct plasticity, will result in the model strength. The model has been taken as the usual 1 : 2 : 3 mixture, with the fine aggregate varying from ¼-in. in size to the finer particles and the coarse aggregate varying from ¼-in. to 1½-in. pieces. Such a concrete tested in the laboratory, after being mixed to correct plasticity, gives a 28-day test of 3,000 lbs. per sq. in. This is the basis of the table prepared. A copy of this table forms part of this paper as it forms a reference for the suggested specification revision and also a valuable reference for every day use.

Five different fine aggregates were used with the upper limit of size from 1/28 in. to 3/8 in. A large variety of coarse aggregates were used with the smaller limit varying from ¼ inch up to 1 in. and the larger limit from ¾-in. to 3 ins. There are 27 variously-sized coarse aggregates which, in combination with the five varieties of fine aggregates, gives 135 combinations.

In every case the aggregates to be used are to be of material sound, clean and free from organic impurities. Then the resulting concrete mixed to ideal consistency, will give a concrete equal in strength to the model mixture, namely, 3,000 lbs. per sq. in. Then when it is remembered that the wearing quality or resistance to abrasion of concretes vary as the compressive strengths, it is seen that each of the mixtures in the table will result in a concrete of standard wearing quality and this is the feature applicable to cement concrete roads.

Rules for Size of Aggregate

Certain rules are necessary in order to determine the limits of the sizes of the aggregates for a proper use of the information in the tables. Prof. Abrams defines, for instance, that a fine aggregate must contain 10 per cent. or more of sand from ⅛ in to ¼ in., to be classed as having an upper limit of ¼ in. If less than 15 per cent. by volume of the material passes the sieve with four openings per inch and is retained on the sieve with eight openings per inch then the sand should be classed as ⅛-in. sand.

For coarse aggregates the rule laid down is that there shall be not less than 10 per cent. of material between the largest size and the next smaller size shown in the table. Thus a coarse aggregate, to be classed as 2½ in. size, shall have not less than 10 per cent. of the material between the 2½ in. size and the 2 in. size. If there is less than 10 per cent. between these two sizes then it would be classed as a 2 in., providing there should be at least 10 per cent. retained on the 1½ in. screen. The lower limit of size of a coarse aggregate shall be the largest size shown in the table for coarse aggregate, below which there is not to exceed 10 per cent. by volume of the material. Thus a coarse aggregate in which the lower limit of size is to be 1½ in. should be an aggregate in which there is not to exceed 10 per cent. by volume of the material passing a ½-in. screen. In all coarse aggregates if there is to exceed 5 per cent. of the volume passing a ¼ in. sieve then such excess shall be considered as fine aggregate and the amount of fine aggregate to be used is modified accordingly.

The table gives the proportions of fine and coarse aggregates and unit quantity of cement and also gives the quantities of each required for 1 cu. yd. of mixed concrete. These quantities do not make any allowance for waste so that for practical estimates they should be increased according to experience and construction methods employed.

It is interesting to note in connection with the information given in the tables for quantities of cement required per cubic yard of mixed concrete that for the finer coarse aggregates, the amount of cement per cubic yard of concrete increases. For instance, for a coarse aggregate of from ½ in. to ¾ in. particles, 1.96 bbls. of cement is required in a cubic yard of concrete, while with a coarse aggregate varying from 1 in. to 3 ins. and a fine aggregate up to ¼ in. only 1.49 bbls. of cement is required to give a cubic yard of mixed concrete that will reach the standard test of 3,000 lbs. per sq. in. in 28 days. This shows that materials that previous specifications did not admit will give a model concrete and actually save cement.

Organic Impurities

In the aggregates considered in the table they must be free from organic impurities. In the sands, especially, tests should be made to make sure that no organic impurities are present and the following is a test simple and readily performed in the field: Shake a few ounces of the sand in a 3 per cent. solution of sodium hydroxide and upon settlement over night, observe the color of the clear liquid. If colorless or, at the most, light yellow color, freedom of organic impurities is indicated, whereas, if the liquid is a decided amber or brown color it is an indication of an amount of organic impurity which should not be allowed in concrete for road purposes. A small amount of organic impurity is sufficient to reduce the strength of the concrete a third or a quarter and only a comparatively small amount is necessary to cause complete disintegration of the concrete.

Specifications for Proportions Using Abrams' Tables

The proportions of cement, fine and coarse aggregate for the concrete, shall vary according to the sizes of the fine and coarse aggregates to be used, as indicated in Abrams' table of proportions and quantities as printed herewith. One sack of cement is to be considered as 1 cu. ft. and proportions are to be by volume. The quantity of cement in 1 cu. yd. of concrete in place shall be not less than the amount as shown in the table for a given proportion of coarse and fine aggregates.

Before work is started the contractor shall advise the engineer of the particular sizes of fine and coarse aggregates he expects to use and no change shall be made by the contractor from such sizes except upon due notice in writing to the engineer.

To determine in what classification a given aggregate shall fall the following method shall prevail: For fine aggregate there shall not be less than 15 per cent. of the total volume between the coarsest size and the next smaller size shown in the table. Thus, if fine aggregate is to be classed as ¼-in. there shall be not less than 15 per cent. of the material between the No. 4 screen and the No. 8 screen.

In coarse aggregate there shall be not less than 10 per cent. of material between the largest size and the next smaller size shown in the table. Thus a coarse aggregate to be classed as 2½ in. size, shall have not less than 10 per cent. of the material between the 2½-in. size and the 2-in. size.

In each instance, whether fine or coarse aggregate, if there is not of the coarser sizes the amounts as here described, the upper limit of size of the material is to be that of the next smaller size. That is, an aggregate that contains some 2½-in. material, but less than 10 per cent. between 2½ in. and 2 in. is to be classed as 2 in. size for the upper limit.

The lower limit of size of a coarse aggregate shall be the size shown in the table for coarse aggregate below which there is not to exceed 10 per cent. by volume of the material.

If there is to exceed 5 per cent. of the volume of coarse aggregate passing the No. 4 screen then such excess shall be considered as fine aggregate and the amount of fine aggregate to be used shall be modified accordingly.

Aggregate falling between limits of sizes other than shown by the table may be used only upon special written permission of the engineer and in such proportions as he may indicate.

In all cases aggregates, both fine and coarse, are presumed to be reasonably well graded between the limits specified.

Finishing and Curing

Finishing methods have benefited greatly by improvements during the last year or two and these improved methods permit of a nearer approach to the ideal concrete mixture and so are productive of a concrete surface of much higher wearing qualities than were originally produced. Floating has been replaced by rolling and belting, either by hand devices or by machines of more or less elaborate types. The previous floating method was a temptation to produce a concrete too high in mortar and of too wet a consistency. The new method includes the strike board or template to bring the placed concrete to its correct contour and then after standing a short time a light roller is pulled backwards and forwards transversely. This roller serves to slightly consolidate the concrete, bringing the mortar to the surface and also removing any excess water. The finishing is then completed by belting, which consists of dragging a canvas belt with a zig-zag motion transversely over the surface of the rolled concrete. This gives a more perfect finish than any floating methods could possibly produce and it is easier to operate and gives quicker results.

Lastly comes the curing process and it forms another important step in the production of a successful concrete road. The whole object should be to secure a slow and uniform hardening process for the finished concrete and the methods should vary with the seasons. In hot, dry weather, for instance, the freshly finished concrete should be protected from the sun by canvas covering until sufficient set has taken place to permit of the placing of the earth covering or the water ponds. The period for retaining such moist covering will depend on the temperatures, but a general tendency is to leave the road closed for curing for a longer period than heretofore. Instead of a fourteen-day minimum some specifications wisely provide for a twenty-one day minimum period for curing. There is a temptation to be impatient and to permit of rapid curing and drying and the opening to traffic after a shorter period than mentioned above, but this is most certain to be followed by ill effects to the wearing of the road as time goes on.

Expansion Joints and Cracking

There is an increasing practice of omitting entirely expansion joints in the construction of concrete roads. The chief advantage gained is the avoidance of an uneven surface at the joints which is only avoided by extreme care in finishing in the vicinity of the joint when used. Expansion joints in usual practice are placed from 25 feet to 50 feet apart, depending on the width of the pavement and also having regard to the season of the year at which the concrete is placed.

The Normal Business Cycle—Consists of (a) Depression; (b) Revival; (c) Prosperity; (d) Financial Strain and Liquidation of Securities; (e) Brief Crisis and Liquidation of Commodities—Where are we "at" To-day?

The normal business cycle, as it occurs in the absence of special disturbing factors like a great war, has been carefully worked out by a number of recent writers.* The description may start at any place in the business cycle, and the analysis will work around again through the cycle to the starting point. It is convenient to start with the close of the period of depression.

At the end of a period of depression we find the following situation: (1) prices are low; (2) there have been drastic reductions in costs; (3) the margins of profits are narrow; (4) bank reserves are high; (5) conservative policies obtain as to borrowing, capitalization and loans; (6) stocks of goods on hand are moderate; (7) buying is cautious. In such a situation an expansion in the physical volume of production and sales takes place, often with prices still falling. During the period of depression which is coming to a close, people have used up their stocks of clothing and shoes, have reduced the volume of household furnishings, linen, china and the like, factories have allowed equipment and stocks of raw materials to get as low as seems wise, and new buying is forced upon everyone who is in a position to undertake it. Moreover, a growing volume of conservative business men and investors who had "sold out" on the crest of the preceding wave of prosperity, have reached the conclusion that things have about reached bottom and are disposed to invest or to start business again. There comes then a slow and cautious revival and expansion in the physical volume of trade. Slow at first, this process is cumulative, and it gradually turns slow business into active business. The revival may start in a narrow field, because necessarily it spreads to other fields, because the active concerns will have more spending power, which leads them to increase their buying from other enterprises. The active concerns, moreover, employ more labor, which increases the spending power of laborers and increases the demand for many things. Increased retail demand leads to increased demand on jobbers and wholesalers, who pass it on to manufacturers, who take on more laborers, who increase their retail buying. The quickening of industries reacts on the starting point, which in turn is quickened and gives renewed impetus to other fields.

There comes, moreover, a psychological change. The "temper of business" is not a thing which is made by men as separate individuals. Rather, it is a social product. The man who finds business in his own line expanding becomes an optimist with regard to business at large. He talks with other men. They, even though they have not felt increased orders for their own goods, begin to be influenced by his optimism. The process is partly rational and partly non-rational. The mere fact that men find their neighbors more cheerful influences them unconsciously even in the face of facts. On the other hand, the man who has been delaying an increase in his own business activity may well find a valid ground for taking positive action if he finds increasing confidence among those about him. The temper of business, an intangible and psychological thing, is, none the less, one of the most fundamental realities with which business men must reckon. No business man can run counter to a general feeling of despondency, even though he be sure that it is ill-grounded, without incurring risk of loss. On the other hand, a business man may well find it worth while to "swim with the tide" of business optimism for a short time at least, even though he be sure that it is ill-grounded. There are, in the business world, a few strong figures who can stand out against the prevalent optimism or pessimism, little influenced by it, and profit by running counter to it, but to do so requires a long purse, a clear head and unusual courage.

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*By far the best book on the subject is that of Wesley C. Mitchell, whose "Business Cycles," published by the University of California Press, in 1913, contains a wealth of statistical materials, by which the theory of the matter is carefully checked.

The price level is often slowly falling when the revival begins, but the expansion of trade stops this. For when business men have plenty of orders they stand out for higher prices. Moreover, when prices start to rise, the expectation of higher prices makes buyers increasingly eager. The rise of prices, like the volume of trade, spreads rapidly through all fields. The advance in prices in one establishment puts pressure on someone else to recoup himself.

The rise of prices is uneven. Retail prices lag behind wholesale prices. Consumers' goods lag behind producers' goods. Finished products lag behind raw materials. Retail prices are influenced a good deal by custom. Moreover, the retailer's total costs do not increase as fast as the wholesale prices he has to pay. His overhead charges do not increase as fast as wholesale prices do, and even if he adds all the increases of the wholesale prices to the retail prices, the percentage increase in retail prices is not so great as the percentage increase in wholesale prices.

Unspecialized raw materials, like pig iron, tend to rise faster than finished products, like knives, because they respond more quickly to demand from many quarters, increasing demand not only for knives but also for steel rails, for wire fencing, for tin plate and for many other things.

Wages often rise more promptly than wholesale prices, but in general the increase is much less. Wages are much more influenced by custom than are wholesale prices. Discount rates rise sometimes faster and sometimes more slowly than wholesale prices. Interest rates on long time loans move slowly in the early stage of the revival. The prices of stocks, especially common stocks, advance before the rise in wholesale prices, and go much higher than wholesale prices.

The unequal rise in prices in the great majority of cases means a great increase in profits in the revival period, since most of the elements of cost rise more slowly than wholesale prices. Raw materials, and sometimes bank rates, rise faster than finished goods, but wages lag behind, while supplementary costs or overhead charges are commonly fixed by old agreements covering rentals on leases, salaries and interest on bonds.

The increase of profits and the prevalence of optimism leads to a great increase in investment. This means more orders and higher prices for structural steel, other building materials, machinery, etc.

These factors are cumulative. The rise in prices at one point, increasing the incomes of those engaged in a given industry, increases their ability to buy, which stimulates others, and so on.

Why should not this process continue indefinitely? What is there to bring prosperity to a close The answer is to be found in several factors.

For one thing business mistakes are made. Heavy investments are made in enterprises which either fail to return profits or else fail to return them on the scale expected. The crisis of 1873, for example, grew largely out of an overbuilding of transcontinental railroads, which ran so far in advance of the development of population that they were unable even to earn interest on their bonds. In some measure, overextensions in particular lines, with the result that profits fail to materialize, and even fixed charges fail to be earned, occur in every period of prosperity. Business optimism tends to run beyond reasonable limits. Speculative imaginings take the place of careful calculation.

In the second place, even though business plans be soundly laid at the beginning of a period of prosperity, taking into account the prices and costs that prevail at that time, the very prosperity itself may so alter the data on which the plans were made as to construction and other costs, as to upset the plans, and make it necessary for the enterprise to call a halt, take stock and readjust. Finally, throughout the business field, as the period of prosperity goes on, there is a tendency for costs generally to rise at a very rapid rate.

During the early part of the prosperity period, supplementary costs, or overhead charges, tend to decline per unit of output until existing plants are fully employed. When, however, production necessitates an increase in plant, the overhead charges increase more rapidly than the output. Leases and other contracts expire, moreover, and have to be renewed at much higher rentals. Bond issues at low rates of interest mature and, especially toward the end of the prosperity period, renewals can be made only at much higher rates. So strikingly true is this that it regularly happens that strong corporations, toward the end of a boom, will defer the refunding of maturities and issue short-term notes, expecting after a year or two to be able to refund them into long-time issues at lower rates. The pressure on the capital market grows more and more intense as property increases. Prosperity breeds extravagant consumption, and extravagant consumers save less for investment. Even those who regularly save for investment find it increasingly difficult to do so as the cost of living rises. The end of a period of prosperity is almost always characterized by high interest rates on investments and by a great scarcity of new money for long-time investment.

Short-term money rates and the rates on commercial paper rise, making it more expensive for the wholesaler to carry his inventories or for the manufacturer to carry his materials and work in process.

Other costs increase rapidly. Old plants and ill-located plants are brought into use as the better plants, which alone were worked in the period of depression, are fully utilized. The output of these old and ill-located plants is turned out at a higher cost. Labor cost rises perhaps most of all. This is not due only to the increase of wages. It is due partly to overtime work for which higher rates are paid. It is due partly to the weariness of the laborer, which overtime work involves. Laborers cannot engage in overtime work week after week and month after month without reducing their efficiency. Employers, seeking to enlarge their labor force, moreover, are obliged to take on undesirable individuals who would not be employed in a depression period. Perhaps most important of all, shop discipline is lessened in a prosperity period. Laborers who are sure that they can get a job for the asking across the street cannot be held to their tasks in a period of prosperity as they can in a period of depression. On this point both laborers and manufacturers seem agreed. Laborers complain of "speeding up" in a time of depression, and manufacturers complain of "loafing on the job" in a period of prosperity.

Managerial efficiency is lessened as the pressure of prosperity increases. Managers cannot watch the business so closely. Small wastes multiply, rush orders make for confusion. The pressure, moreover, which working on small margins involves, is removed.

The very prosperity of most businesses imposes serious burdens on those businesses which are least able to raise their prices or to increase their markets. Where prices are fixed by law or by public commissions, as in the case of municipal utilities or railways, a prolonged period of prosperity is apt to increase costs seriously at the expense of profits. Businesses tied up with long-time contracts are similarly placed. Moreover, there are always lines in which recent construction has grown faster than the market. Maladjustments increase. High rates of interest not only check current demand for goods of various kinds but also make it difficult for speculators to hold them off the market.

Consequently at the height of a period of prosperity, an important minority faces declining and vanishing profits. The decline of profits means the doubtful solvency of many outstanding credits. In such a situation it is only a question of time until a readjustment and liquidation is forced. Creditors begin to get nervous. The very rise in interest rates tends to reduce the values of investment securities which have been used as the basis of collateral loans—a phenomenon well known in the bond market. The basis of all credit is, in last analysis, earning power, and with the actual or prospective decline in the profits of a business, its creditors, whether banks or other businesses, tend to demand additional security or to insist on contraction of credit. When profits get shaky, creditors get nervous and force liquidation. A crisis comes. The liquidation extends over the whole field. If a debtor is pressed he is obliged to press his own debtors. The pressure may take the form of offering extra inducements for prompt settlement, as where a seller offers a buyer more than the customary 2 per cent. discount for cash. It may take many forms. If one man succeeds in meeting the pressure upon himself he does so at the expense of others who are embarrassed by it. A sudden change takes place in the temper of business. For many business men the question of profit-making gives place to the question of maintaining solvency. Business men quit pushing sales vigorously, especially when doubtful of the credit of buyers. There comes a rapid falling off of the volume of business. Even when few failures occur the temper of business changes. Pessimism replaces optimism—sometimes almost overnight.

If banks fail to pay their depositors on demand and if they contract loans (or fail to expand loans) a panic comes. This has happened in America a number of times, notably in 1893 and 1907. It did not happen in England, Germany and France in those years because of the better organization of the banking systems. There is little chance of panic when depositors can get their money on demand and when solvent business men can borrow the amounts necessary to meet their pressing obligations.

If a panic comes, a great many plants are temporarily shut down. With the passing of the panic these are reopened and there comes a short-lived revival immediately after the panic. This short-lived revival is chiefly for the purpose of finishing orders not wholly completed, for delivery to solvent firms who do not desire to buy the goods but who are obliged, under their contracts, to take them. New orders do not follow, however, and a period of real depression follows. In this period, consumers' demand falls off as labor is discharged and as profits fail to appear. Investors' demand for construction falls off most of all. These tendencies are cumulative just as the reverse tendencies in the period of prosperity were cumulative. The falling off of orders in one business reacts on the other businesses which sell to it. Prices fall. Wholesale prices fall faster than retail prices. Raw materials fall faster than finished products. Wages do not fall so fast, but they fall. Common stocks fall faster and farther than anything else. High-grade bonds, on the other hand, tend to rise as investors turn to the safest forms of investment, and as the pressure on the capital market is relaxed.

The depression lasts until liquidation is completed. Inefficient firms are weeded out. Costs go down. A reorganization of leases and of bond issues brings rentals and other fixed charges down. Interest falls. Bank rates get low. Bank reserves increase. Labor costs go down. This is partly because wages go down, partly because overtime work ceases, partly because shop discipline improves, partly because the least efficient laborers are unemployed.

We are thus brought back to the point at which we started, the point at which a revival is due. As the depression period continues, clothing, materials, structures, machinery, etc., wear out. Population continues to grow; bargain sales of the equipment of defunct enterprises cease, and new things finally have to be bought. The men who have been waiting for "bottom" to be reached, decide that the time for action has come. At low prices business begins to increase, and the cycle of prosperity, crisis and depression starts again.

Making Freight and Passenger Elevators Safe

W. D. Black of Otis-Fensom Elevator Co., Toronto, Before Ontario Safety League Outlines Causes of Accidents and Their Elimination

IN considering elevator hazards it is well to review briefly the evolution of the elevator and the results sought, or attained, in improving their safety features and to keep this in mind while analyzing statistics dealing with elevator accidents.

Prior to the advent of the steam passenger elevator, nearly six decades ago, buildings were limited in height and, while this type of elevator encouraged the addition of a few storeys, its operation in the early days was too slow to make any general increase in buildings until some twenty years later when the hydraulic elevator was introduced and rapidly improved in methods of construction and operation.

In 1876 there were in the City of Toronto nine passenger elevators of the hydraulic type with copper cylinders, several of which remained in service for twenty-five years. At that time there were also a few hand operated hoists, without cars attached, that lifted the load through openings in the floors provided with hinged doors on which the load was landed. The last of this type, to the best of the writer's knowledge, was removed from a building on Colborne Street a year or so ago.

The belt drive, spur gear reduction, drum type machine was built and installed as late as 1905, but was used only for freight service on account of its slow speed.

In 1882 the first worm gear reduction, motor driven elevators were installed in this city, driven by belts, from a countershaft operated by constant running motors.

In 1892, the first direct connected, motor driven elevator was installed in Toronto, and the development has continued to the present day 1:1 traction elevator, which has put the elevator engineer so far ahead of the construction engineer that he can equip a building with elevators to any height demanded and running at any speed compatible with comfort.

It is estimated that the number of passengers carried daily by elevators in large cities exceeds the number carried by all other means of transportation, and it speaks well for the elevator engineer's attention to safety features that so few of these passengers are injured.

The Weaknesses to be Avoided

We will outline the things it has been considered by the designers as unsafe in elevator practice and to avoid which various features have been embodied in the design of the modern elevator.

1. To fall unretarded to the bottom of the hatchway.
2. To be overhauled by the counterweight so that the car hits the overhead work.
3. To permit the car or counterweight to over-run their limits of travel at top or bottom.
4. To use safeties so severe in action as to cause a dangerous impact in stopping or engage only on one guide rail.
5. To permit the machine to continue to operate after lifting ropes have slackened for any reason.
6. To lose control of the car to such an extent as to alarm the passengers to a point of attempting to jump off a moving car.
7. To permit operation of the elevator until the hatchway door is closed.

It is not within the scope of this paper to attempt to describe the various devices designed to meet the above contingencies, but it is well to bear in mind that on many of the older elevators some of the most necessary items were not included and on some, where included, the design was so crude as to make them inoperative, and it, therefore, is important for all inspectors to thoroughly satisfy themselves that the elevator under inspection is sufficiently equipped with such safety features as to meet the service for which the elevator is used. It is unfortunate that the inspector rarely has the power to condemn and have removed an elevator which, in his estimation, is improperly equipped with safety features, or, on which these features are defective in design, or, inoperative. As a rule he must bide his time until an accident does occur when the owner is morally, if not legally, forced to renew the equipment.

Causes of Casualties

In the Provincial records of 1909-1916 there are recorded thirty-seven casualties resulting from the dropping of about twenty elevators, a large proportion of these injuries being serious. In practically all cases the elevators were of old and obsolete design, not properly equipped with safety catches, and almost invariably designed and installed by concerns who carried elevators as a side-line and did not have the experience or knowledge to properly build such equipments. Fortunately, the elevator business has developed to a point where practically all elevators are built by specialists in that line and such accidents on the modern installations are rare. In one case where an elevator dropped, causing four of the thirty-seven casualties above referred to, the safety was rendered inoperative by a screen installed by the owner in such a way as to interfere with the safety operating spring.

In all cases, the inspector should test the operation of the safeties as they are the ultimate means relied on to save serious injury in the event of weakness developing in the ropes or equipment due to poor design, faulty construction, or latent defects which are impossible of detection until the part fails.

There are in service many handpower elevators on which operators ride from floor to floor with the loads. This is a practice which should be prohibited because, even with safety catches, there is danger of the weight overhauling the car and causing serious accident. The Toronto Civic Regulations insist that the pull rope of such elevators be placed outside the gates, where the operator cannot ride on the car. This is a good precaution that would be well to be applied more generally as this type of elevator is more susceptible to "drops" than even many of the power-driven machines.

Carelessness Caused 80 Per Cent. of Accidents

Out of a total of one hundred and eighty elevator accidents reported by the Provincial Government for the eight years, 1909-1916 inclusive, the above mentioned thirty-seven, or approximately 20 per cent. were reported due to the falling of elevators over which the operator presumably had no control, the balance, or approximately 80 per cent. of the total, was due to carelessness or foolhardiness. It is interesting to note that 42 per cent. of these accidents occurred to boys varying in age from eleven years to seventeen years. The one hundred and eighty accidents referred to are reported as occurring in approximately the following manner:

1. Dropping of elevator	37
2. Caught between elevator and walls or projecting cills	75
3. Fell down the hatch	37
4. Head caught between car and gate	18
5. Injured in attention to machine	6
6. Caught under car	5
7. Fell off elevator	1
8. Cleaning elevator hatch	1

The first item, viz.—Accidents due to dropping of elevators, has already been considered.

The second item—crushing by elevator—is probably due largely to lack of proper enclosure on the car to protect the sides and rear and to projecting sills in the front of the hatchway. It appears necessary, therefore, to insist on proper car enclosures, and the use of deep bevelled toe plates, making an angle of not less than 60 degrees with the horizontal, which is essential under all thresholds, beams and other fixed construction projecting into the hatchway more than 1-in. Doubtless many of these accidents occurred as a result of playful scuffling of youths in the elevator, where they are usually out of sight of the foreman. Another cause of being caught is the habit employees have of jumping on or off moving cars. This practice is dangerous enough with reference to the moving platform only, which is much complicated in most cases by the fact that as the car is leaving the floor the automatic or semi-automatic gate or self-closing door is moving, constantly cutting down the clearance with the result that the person trying to board the car is upset by the car, gate or door, and very serious accidents usually result. Such accidents are only too common on freight elevators, but rarely occur on passenger elevators in charge of regular operators. It is to be hoped that future development of the freight elevator will include inter-locking features which will prevent the moving of a car until all entrances to the hatchway are closed.

Some Accidents Not Avoided by Mechanical Devices

The third item—falling of men down the hatchway is in many cases not subject to reduction, except by "Safety First" signs which will emphasize the necessity of caution, but such accidents are too often due to the careless leaving open of hatchway protection doors and gates, which are frequently found nailed up to avoid the handling, or due to procrastination in calling in repair men.

The fourth item, which lists the accidents due to crushing of head and shoulders between the car and gate, is usually due to the fact that the gate is sufficiently low to permit of a person putting his head over same in his curiosity to locate the elevator. It is curious that he invariably looks down, and it frequently happens that the elevator is descending just in time to pin him between the bottom of the car and the gate. It is necessary that all gates be not less than 4 ft. 4 in. in height. In cases of old installations, where it would be a hardship for the owners to install gates of this height, warning loops of sash cord or light chains should be hung from the front edge of the platform. It also frequently happens that a person looks over the gate after the platform has passed down and is caught in this position by the enclosure top of the car. To avoid injury from this cause the front section of the cover to a depth of 9 in. should be made to hinge on freight elevators.

The fifth item covers injuries received by attendants in caring for the equipment. Such injuries are usually minor in character and usually due to carelessness, but would be reduced by making the machine more accessible and by providing more room around the machine than has been the rule in the past.

The sixth item, covering accidents due to men being crushed below the elevator, is usually due to their using hatch doors or space below the elevator as a passage. Such practices should be strictly prohibited and, in fact, the use of hatch doors should be abandoned entirely as they are the direct cause of numerous accidents.

The seventh item covers injury due to falling off the elevator. It is frequently noted that on old elevators, unenclosed, the back wall has several offsets and in many cases deep-set windows which provide ample space for a person to fall off, and it is surprising to note that such few accidents are reported from this cause.

The eighth item covers an accident due to injury received while cleaning the elevator hatchway. Such are probably unavoidable by any mechanical precautions that could be taken.

Toronto's Accidents Due Largely to Negligence

It is now interesting to analyze the class of accidents that occur on elevators of the passenger and warehouse type in the City of Toronto over which the City Architect has jurisdiction according to a by-law passed July 14th, 1907. The City Architect, as "Inspector of Elevators," has in this department three inspectors, all practical men with years of experience in elevator construction, who every three months inspect all elevators licensed by the city. During 1919 elevators to the number of 881 were licensed.

Mr. Price, City Architect, has very kindly furnished the writer with data as listed below, which shows the number of accidents, fatal and otherwise, which have occurred in connection with the elevators under his jurisdiction, which do not include factory elevators, for the period 1918 to date.

	Fatal.	Injured.
1. Making repairs without first locking car	5	1
2. Open gates	9	9
3. Leaving or boarding moving car	5	4
4. Projection over hoist floor	1	8
5. Open space between stationary and elevator floors	2	0
6. Operating car while standing outside same	7	1
7. Starting car without first closing gate	0	2
8. Breaking of mechanism	0	2
Total	29	27

Analyzing this record indicates that practically all may be classed as due to carelessness by the victim, negligence by some other party, such as leaving gates open, or foolhardy practice such as operating the elevator from the landing which is especially dangerous in the case of the hydraulic type elevators.

Mr. Price, in his letter comments: "Although accidents on elevators have not been entirely eliminated, they have been reduced to a minimum by various mechanical innovations, such as automatic gates, locking devices, etc., but it would seem that the day of the fool-proof elevator has not yet arrived when one looks into the lists of accidents and the cause of a large majority of same, viz.: raising and propping up automatic gates, making it possible to board or leave a moving car, which would not be possible were the doors and gates closed; operation of elevators by employees other than the operator; the use of freight elevators for passenger purposes. It would seem that the only way to guard against such accidents would be a campaign to educate the employees against such dangerous practice."

In conclusion, it is the writer's opinion that Section 58 of the Ontario Factory Act, which applies to elevator regulations, is obsolete and entirely inadequate. In several provinces and states elevator ordinances have been drafted by "Boards" composed largely of elevator engineers, and this has resulted in improved new installations, and the correction of many glaring faults in exising installations and their enforcement must result in a decided reduction of elevator accidents. I would strongly recommend that the Ontario Safety League use their influence in having the Government appoint such a "Board" with a view to drafting a comprehensive set of rules and regulations, the enforcement of which would result in the reduction of elevator accidents to the lowest possible minimum.

Federation of American Engineering Societies

Formed at Organizing Conference at Washington, D.C. on June 3-4— To Make the Engineer a More Potent Factor in Public Affairs

AT WASHINGTON, D. C., on Thursday and Friday, June 3 and 4, at a conference of the national, local, state and regional engineering and allied technical societies, the foundation was laid for the most comprehensive organization of engineers in any country. Under the title of The Federated American Engineering Societies there has been set up a form of association embracing all the engineering professions, with the definite object of establishing machinery whereby engineers as a group can render service in the public affairs of the city, the state and the nation whenever engineering experience and technical knowledge are involved and to consider and act upon matters common to the engineering and allied technical professions. Delegates from fifty-seven societies were present from all sections of the United States out of a scheduled representation of sixty-seven.

The form of the new organization, based upon membership of societies and affiliations instead of individuals, which has been under consideration for some time, was planned under the direction of Richard L. Humphrey as chairman of the joint conference committee of the four founder engineering societies and member of the American Society of Civil Engineers. In opening the first session on Thursday morning at the Cosmos Club, Mr. Humphrey reviewed the work of the joint conference committee and explained the activities of the Engineering Council, which has in a limited way during the past three years functioned along lines similar to those proposed for the more comprehensive organization.

The Preliminary Resolution

Formal presentation of the following resolution by Gardner S. Williams, member of the American Society of Civil Engineers, opened the debate on the plan of organization:

Resolved, That it is the sense of this conference that an organization be created to further the public welfare where technical knowledge and engineering experience are involved and to consider and act upon matters of common concern to the engineering and allied technical professions, and

Resolved, That it is the sense of this conference that the proper organization should be an organization of societies and affiliations and not of individuals.

Opposition to the principle of membership by societies instead of individuals came largely from members of the American Association of Engineers. That organization, which is made up of more than 18,000 individual members, has during the past five years had a rapid growth based upon its activities in welfare work of benefit to engineers in all professions. In accepting the invitation to send delegates to the Washington meeting this association contended that the organization of a national association of engineering organizations with representatives widely chosen by local affiliations and national organizations would duplicate the effort of the A. A. E. and add useless machinery. It was along these general lines that arguments pro and con were advanced. The debate, however, was brief, and when the resolution was put to a vote the seventeen representatives of the American Association of Engineers, on account of the alphabetical position of that body in the list of participating organizations, cast the affirmative votes. This action effectively dispelled any feeling of antagonism toward the new movement, and the resolution was unanimously carried by 119 votes from representatives of fifty-two of the fifty-seven societies present. With this point settled, the order of business of the first session was completed by the appointment of committees on program, credentials, constitution and by-laws, and resolutions.

Constitution and By-laws

The sessions on Friday morning and afternoon were largely devoted to a discussion of the form of constitution and by-laws drawn up by the committee. In the vote on the constitution, eighty-eight representatives of forty-nine societies voted in the affirmative, with representatives of eight societies reporting "not voting." Among the latter was the American Association of Engineers. William J. H. Strong, the chairman of the delegation, in reporting its vote made a statement in part as follows:

"The American Association of Engineers has stood for co-operation. Our delegates came to this conference in good faith; we have acted there in good faith, and we wish to continue to act in the future with equally good faith for the welfare of the public and the engineers as a profession, as well as for the individual engineer.

"We would call your attention to the fact that while our vote of today will be a disappointment to you, yet we have in every way sought to co-operate with you, if not on one basis, then upon another. We sought in the first place to show you that the form of organization which you have planned is historically wrong and cannot be made to function properly, and we have recited valid historic precedent for this judgment. The structure also seems cumbersome and certainly the relations between the council and the board will have to be either altered or ignored. Such discrepancies, however, are usually present in new endeavors and under able management will no doubt ultimately be ironed out. We would also state that the construction as presented is contrary to a well-accepted principle, that "taxation without representation is tyranny," and therefore if for no other reason the delegates of the American Association of Engineers cannot ratify this constitution with the basis of representation therein outlined. Such representation under this constitution would work out for the American Association of Engineers about as follows: Under this constitution the American Association of Engineers would shortly be called upon for $32,000, and its voting representation would be on a basis of only one to sixteen. In other words, the dollar of dues paid by the small units of the federated societies would have sixteen times more voting power than the dollar paid by the American Association of Engineers. We stand unalterably on the principle of a dollar of vote for each dollar of dues.

"Further, our association offered to you its own organization established, proved and in successful operation, subject to such modifications as would make it sufficiently comprehensive to carry on the work it is now successfully doing and to include the fields of activity which the new federation chiefly aims to cover, as evidenced in the resolution of June 3. This you declined.

"We then, as is known to some of you, offered to divide the field of co-operative engineering effort, we to take the welfare work pertaining to the individual engineer as an individual, and you to take the work outlined in the first part of the resolution of June 3. This you also have refused.

"In accordance with the practice of our association in times past to make special appropriations of funds to attain special objects of interest to the engineering profession, we then offered a suggestion that you specially provide in your constitution the channel for such appropriations, so that we might respond financially should you desire such support from us and we make the necessary appropriation. This also was rejected in the form in which we suggested it.

"Up to the present the engineer has evidenced very little of the real co-operative spirit we are teaching it in the American Association of Engineers, and while we at present recognize, as is evidenced by this conference, that two societies are necessary at the present time, it is our earnest hope that as time passes and the ability of engineers to co-operate successfully is developed ultimately there may be one large society covering all interests of engineers and all technical men, but while we await that ideal condition be assured that we shall in no point fail to co-operate with you within the limitations which we have outlined.

"We again express our appreciation for the entertainment which you have so generously extended to us. Words by members of this conference have placed a burden of responsibility upon us to keep faith and that we ring true to you and to ourselves, and it is therefore in the light of the above that I announce seventeen delegates of the American Association of Engineers present but not voting."

Management Through American Engineering Council

The constitution as adopted provides for three main classes of membership. (1) National engineering and allied technical organizations; (2) local, state or regional engineering or allied technical organizations other than local associations, sections, branches or chapters of national organizations, and (3) affiliations consisting of local sections of engineering associations, clubs and local engineers. Management of the organization is vested in a body to be known as the American Engineering Council and an executive board. The former, made up of representatives of the member societies, will be the name under which the work of the federation will be generally known and will co-ordinate the activities of the state councils and the local affiliations. It will be a large body made up on the basis of one representative for a membership of from 100 to 1,000 inclusive and one additional representative for each additional 1,000 members of each national, local, state or regional organization of affiliation.

"The executive board will consist of thirty members of the council and be charged with conducting the business of the organization under the direction of the council. Six of the thirty members will be officers chosen by the council and twenty-four selected by the national societies, local or regional organizations or affiliations according to districts.

The financial needs of the organization will be derived from member societies on the basis of $1.50 per year per member of the national societies represented on the council and $1 per year per member of local, state or regional organization or affiliation. On this basis a revenue of $75,000 per year is estimated at the start.

[The above report of the conference was prepared by the Electrical World to which journal we are indebted for the right to reprint.]

Shaft Sinking Record

Some new records in shaft sinking are said to have been made recently in South Africa. The south shaft of the New State Areas was sunk 270 ft. in a month and the north shaft 245 ft. The shafts are rectangular, and measure 28 ft. 9 in. by 13 ft. 9 in. About the same time a cross-cut at the Sub Nigel, measuring 12 ft. by 8 ft., was extended 343 ft. 6 in. in the north.

Walkerville Office Building

The John V. Gray Construction Co., Ltd., 541 Queen St. E., Toronto, have been awarded the general contract for the addition to the office building for the Walkerville Land and Building Co., Walkerville, Ont. The contract amounts to about $155,000.

Asphaltic Oils for Sand or Gravel Roads

Sand Oil Roads in Massachusetts Prove Satisfactory for Light Traffic—Suggestions for Their Construction

By William D. Sohier*

WE have in Massachusetts quite a large section of territory where the whole soil is of a sandy nature. This is particularly true on Cape Cod, and in this section of the state broken stone or gravel has to be transported 150 miles more on the railroad, and as two horses can only haul about three quarters of a ton over the sandy roads, the cost of building roads with those materials is practically prohibitive. It became almost imperative, therefore, that we should find some method of constructing roads with the local material, sand, using something else in combination with it that would not be too expensive.

Naturally, the first materials that were used were what was available locally, either clay, if it could be found, and if not, loam, mixed with the sand or spread on top of it in order to harden it sufficiently so that it would not rut very badly. Roads built of these materials, if properly proportioned and kept constantly crowned and shaped, make extremely satisfactory roads for light traffic.

We then began to look around for other materials that might be used which would make stronger roads at a reasonable expense.

The First Sand and Oil Roads in Massachusetts

The first sand and oil roads were constructed by the Massachusetts Highway Commission on Cape Cod in the town of Eastham in 1905. When this road was first commenced, they followed the California method of constructing roads with asphaltic oil, which was to spread the oil on the ordinary soil, which had been broken up, in two or three layers of oil of three-quarters of a gallon to the square yard each, and then after harrowing it, tamp it with a tramping roller which tamped the soil from the bottom up and also mixed the oil and earth together. To do this successfully required the use of a very large amount of water while the work was going on, nearly 12 gallons of water being used for each gallon of oil. In building these roads in California, they use in all about 2 gallons of asphaltic oil to a square yard of surface.

Layer Method Sand and Oil Roads

We very soon found, however, that on the sand this method was not successful and that it was better to spread the oil in layers in what might be called a blanket coat of three-quarters of a gallon to the square yard, covering that with sand, then spreading another similar coat of oil and covering that with sand, and then a top surface of oil, about half a gallon to the square yard.

Mixed Sand or Gravel Oil Roads

In 1908 we tried in several places in the state a number of experimental sections of road by the mixing methods, using various qualities of tars and various qualities of asphaltic oils and residuum oils mixed with asphalt, these bitumens being treated and mixed with the heated sand or gravel, and then spread upon the road surfaces and shaped and rolled.

In constructing either of these roads, you must first carefully prepare your sub-base. On Cape Cod sand, this means that you must harden your sub-base by using clay or loam, so that when the wagons distributing the oil go over it, they will not rut it up very much, nor will the horses' feet cut into it materially. In the first roads that we built, though they were successful in the end, they certainly looked hopeless in the beginning, because of the deep ruts which were formed by the oil-distributing wagons and the sixteen deep holes in the sand that were made by the feet of the four horses. The oil naturally ran into these depressions and left very few drops on the rest of the surface of the road, and of course the result was bunchy oil without enough sand. In the first work that we did we used a gravity distributor, so-called, where the oil ran out of the wagon into a sort of trough, with holes and pipes running out of the trough about 9 inches apart and falling onto a board which was so slanted as to give a reasonably even distribution of the oil. In all our later work we have, of course, used pressure distributors, thereby securing very much better results.

In these first roads, after two coats of oil had been applied, the whole road surface was broken up and very carefully harrowed with a disc harrow, so as to break up all the bunches. The road was then shaped with a road machine, and rolled, to give it a crown of about three-quarters of an inch to the foot. Any weak places which then developed were patched with a mixture of sand and oil, and then a surface coat of about half a gallon of oil to the square yard was applied, and this was covered with sand and kept constantly covered from time to time until no wet oil appeared upon the surface.

In constructing the roads by the layer method, we found the best results were secured by applying about three-quarters of a gallon of oil on the sub-oil and covering this with about an inch and a half of sand. On this, we spread a second three-quarters of a gallon of oil and a second coating of an inch and a half of sand, and the first road that we built had to be broken up and reshaped as I have described. On the later ones, we merely had to shape the roads a little with the road machine and then apply a half gallon of oil for the surface coat, and this was covered with about an inch of sand but had to be kept constantly covered if any wet oil appeared upon the surface. We secured, we thought, somewhat better results, especially if the work was done late in the year, if the road was let go through the winter with the first two coatings of oil, and then shaped and the final surface put on in the spring.

The oil that was used in this work was the same quality of asphaltic oil that was used for hot blanket surfaces, to wit, an oil that was suppposed to contain about 90 per cent. of asphalt and that had to be heated to about 250 deg. F. in order to spread evenly.

A clean, sharp, fairly coarse sand will give the best results, but a comparatively fine sand, and even one containing a small proportion of clay or loam (not more than 5 per cent. or 8 per cent.), will give good results with a proper grade of oil. In the layer road, you cannot use successfully the heavier grades of asphaltic oil, you must use an oil that will continue to mix with the sand during the summer weather. Tests made of the sand used on the work in various places show that the finest sand was such that 24 per cent. passed the 50-mesh screen and only 4 per cent. was retained on an 8-mesh screen, whereas the coarsest sand 12 per cent. was retained on an 8-mesh screen and only 18 per cent. passed the 50-mesh screen.

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*Ex-chairman Massachusetts Highway Commission, before 7th Canadian Good Roads Congress.

We very early found that if roads of this character were to be successful, they should be crowned about half an inch to the foot, and they must be at least 18 feet in width and were much better if they were 20 feet wide, unless there was some material on the shoulder which would carry the traffic without rutting deeply. If a narrower width was used and teams kept constantly turning out, they very soon cut away the side of the road when they came back and narrowed it up, so that at the end of the season, where we built a road 15 feet in width, there was only from 9 to 12 feet of width left. We usually try now to bank the corners and make them 21 feet in width.

Cost

The cost of the surface of these sand and oil roads constructed by the layer method varied from 21 cents to 33 cents per square yard, the average cost being about 26 cents per square yard. This cost does not include grading, culvert work, etc., but does include shaping the sub-grade. The average yearly cost of maintenance of the first section constructed in Eastham 16 years ago has been 2 cents per square yard per year, and of the other roads constructed during the last 11 years 1 cent per square yard.

It must be always kept in mind that in all the figures I am giving in this paper I am speaking of prewar conditions and prices, when the asphaltic oil used cost about 6½ cents a gallon on the cars, and when labor was $1.75 to $2.00 a day and double teams $4.50 to $5.00. For today's costs I think you would have to at least double the above figures.

Mixed Sand and Oil Surfaces

As I stated before, we made a number of experimental sections, using gravel and sand, heated and mixed with hot oil, on a number of sections of road in 1908, but we built our first mile of road by this method in 1909. That road and some of the experimental sections are still on the ground and doing service, although they have been widened and in most instances have had a surface coat. Until 1912, this work was done by hand, the sand or gravel being heated on old boilers or iron sheets with a fire underneath, the oil being heated in a kettle and the two mixed together by hand on a mixing board.

Today we use a hot mixer, at any rate to mix the oil and sand, usually the type of cube concrete mixer operated by steam and equipped with a charging device and heating attachment which consists of an oil burner with an air-blast throwing the flame into and through the mixer. The portion of the mixer with which the flame comes in contact is lined with fire brick.

During the last few seasons, the sand, which was formerly heated on old boilers or arch heaters, has been heated in a revolving drum heater with oil burners, which is very similar to that used in sheet asphalt plants, and on the whole produces more uniform and better results on both sand and gravel roads than any other method. The heating drum has blades or flanges bolted onto the inside which carry the sand or gravel to the top whence it falls through the hot blast from the burners. The drum is inclined to carry the sand slowly to the lower end. It is revolved by either a steam or gasoline engine.

In our experimental sections the only ones that were successful so that they were in good condition at the end of the season, where sand was used, were two or three sections which were constructed of an asphaltic oil supposed to contain from 80 per cent. to 90 per cent. of asphalt, or this same asphaltic oil made stiffer by the addition of 25 per cent. of asphalt. The sections which were built where lighter asphaltic oils were used, or tars, were none of them in good condition at the end of two seasons, and all of them had to be rebuilt.

Where gravel was used, there were a good many more sections that were in fairly good condition for two or three years, though the only really satisfactory and good ones were the ones where the heavy asphaltic oil had been used, or the same oil enriched with asphalt. Some of these sections have carried pretty heavy traffic during the last 12 years.

Good Sub-base Necessary

In constructing these surfaces, whether of gravel or sand, you want a well-shaped, well-rolled and hardened sub-base. The sand and oil have to be heated to the proper temperature and mixed by hand or by machine. If by hand, the mixing is done on platforms with rakes and hoes, or by turning with shovels. The mixing must be continued until every grain of sand is coated with oil.

There are several rough-and-ready methods of determining this. One, when a proper mixture is made and the right quantity of oil is used, the product resulting will be somewhat of the consistency of old-fashioned brown sugar. It should look granular, it should tend to crawl and move for some time when heaped up if you rake it, but it should consolidate pretty well when compressed under the heel or in a cloth, but not enough to become wet or sticky. After it is spread upon the road and rolled, it still has a somewhat granular appearance at first, but this should very soon disappear when much traffic has gone over the road. It then consolidates and becomes watertight. Occasionally hair cracks occur at first, but they close up under traffic. Both of these remarks apply to gravel and oil, as well as sand and oil.

For this work, from 15 to 25 gallons of oil or oil asphalt have been used per cubic yard of loose sand, but ordinarily the best results have been obtained by the use of from 16 to 18 gallons per cubic yard of sand, if loose, or about 18 to 20 gallons if it is compacted.

The quantities of oil used are measured hot, when they expand about one-seventh of their volume when cold.

Sand and Gravel Must be Dry

To obtain satisfactory results, sand must be dry as well as hot. Wet sand or gravel or stone cannot be mixed satisfactorily with either tar or asphalt. It produces a coating of steam which prevents the hot bitumen from adhering to the material.

If the sand in the pit when used is fairly dry, it can be mixed in a hot mixer without preliminary heating, but this is not economical, as from 5 to 6 minutes are then required to mix the batch thoroughly, whereas with hot sand the mixing can be done in about 2 minutes. The oil, before mixing with the sand, is heated in kettles or tanks to a temperature of from 250 deg. F. to 375 deg. F., depending on its density. The oil used for this work with either gravel or sand will vary from 65 to 70 penetration up to 120 penetration; in fact, very satisfactory results will be obtained with "Bermudez," which has a penetration of 120 to 145. The finer the sand, or the more rounded, the heavier the asphalt that must be used in order to make the mixture stiff. The same is true of gravel. The sand or gravel oil mixture, after it has been mixed, is immediately carted to the road and spread, usually in one course, and shaped and immediately rolled. A horse-roller is used for the preliminary rolling, but the surface should be rolled with a tandem steam roller in the course of a few hours. The length of time which should elapse before using the tandem steam roller depends upon the temperature and general weather conditions, but ordinarily any material placed in the morning can be rolled in the afternoon of the same day. Care must be taken not to allow the roller to stand or stop for any considerable time on any of the hot mixture, or it will certainly produce a depression. It should be run back onto the hard mixture, or onto the sub-grade, before it stops. Care should also be taken to try to have the roller-man not stop abruptly, but gradually, as that also produces a shock and consequent depression. We roll diagonally, as well as lengthways. We have found that we secured better shaped sand and oil roads if we keep them constantly shaped with a road machine while we are rolling them with the horse-roller, and fill all depressions, and then put on a surface coat of half a gallon per square yard and cover and keep this covered with sand, than we formerly did when we tried to lay the road all at one time. It is not advisable to use a steam roller on sand and oil roads for the preliminary rolling, as it tends to force the material out of shape and to produce uneven and wavy surfaces.

I will add another warning, and that is that, when it is rather cold weather in the morning or afternoon, especially if the ground is cold, you must be careful to make sure that the middle of your mixture has cooled sufficiently not to squeeze out ahead of the roller, so do not be deceived because both the top and the bottom of the mixture have cooled. Before the tamping roller is used, the middle mixture should be cooled to 70 deg. or 80 deg. or thereabouts, or it has a tendency to squeeze out ahead. Under ordinary conditions, our best results have been obtained with an oil asphalt having a penetration of 90 to 125. If the grains of sand are rounded, especially if the sizes of the grains vary little, as with ordinary beach sand, a very heavy oil asphalt gives the best results, whereas with a sharp sand, well graded and containing a considerable proportion of grains, which will not pass a screen with a ⅛ inch mesh, a less heavy oil will produce good results, probably 90 to 110 penetration should be used.

Sand Tests

Tests made with sand from different pits used for mixed sand and oil work in Massachusetts show that, with the finest sand used with good results, 51 per cent. passed a 50-mesh and only 4 per cent. was retained on an 8-mesh screen, whereas of the coarsest sand 35 per cent. was retained on an 8-mesh and only 12 per cent. passed a 50-mesh screen.

It is evident that a fairly coarse, sharp sand, the particles of which are well graded, gives the best results. It is also true that a comparatively fine sand, the grains of which are sharp and not all of one size, gives satisfactory results, although a heavier oil is required. The coarse sand will probably carry heavier loads and wear longer.

I hesitate to make my next remark, because it is of very limited application and must not be at all extended, and that is that a small amount of clay or loam (not over 5 per cent. or 7 per cent.) is not objectionable, but as any large percentage of these materials will practically ruin your work, their use should not be allowed, unless it is absolutely necessary, or where the sand does not contain a sufficient amount of small grains to make the proper grading. Here vastly better results would be secured by the use of 5 per cent. or 10 per cent. of cement, or even of fine stone dust, if either of these materials can be secured at a reasonable cost.

Surface Cost

After the sand and oil mixture has been thoroughly rolled, the surface is sealed by the application of a hot oil having from 80 per cent. to 90 per cent. of asphalt. This oil is spread by a pressure distributor in two ¼ gallon applications, each followed by a light covering of sand. This coat not only seals the surface of the mixed sand and oil, but also adds about ½ inch to its thickness. It should be constantly covered with sand from the beginning, and also on the first hot days if the work is done in cold weather, so that the surface is never picked up.

Mixed sand and oil surface should have a crown ¼ to ½ inch to the foot, should not be less than 18 feet in width, and better be 20. The thickness should be from 3½ to 4 inches, after rolling and before the seal coat is applied.

Mixed Sand and Oil for Resurfacing and Widening

This is assuming that we are building a mixed sand and oil road on a sand foundation. We have built a great many miles where an old macadam road had been widened and the crown diminished by using a mixed sand and oil of 4 inches in thickness on the side for widening the shoulder, and a surface 2 inches in thickness after rolling, on top of the old macadam road.

Miles of Sand and Oil Roads in Massachusetts

We have in Massachusetts something over 17 miles of road that is still in reasonably good condition that was built of sand and oil by the layer method. We have about 8 miles more of the layer road, where the layer method has been used to widen the road. The average cost of these roads was about 27 cents per square yard. We have 35 miles of mixed sand and oil roads, where that method was used in the original construction, and we have 23½ miles that have been resurfaced and widened, where the sand and oil surface was used on top of the old macadam road. We have about 79 miles of road in all which has been widened using sand and oil mixed.

Cost of Mixed Sand and Oil Surface

The cost of mixed sand and oil surfaces, including the seal coat, has varied from 40 to 61 cents per square yard, the average being 52 cents, until 1919, when the lowest bid that we received was about $1 a square yard for the surface alone. This cost is for the surface alone, and does not include grading and culvert work, etc. The average yearly cost of maintaining these roads, which have been in use at least 9 years, is about 2 cents per square yard per year, and for those that have been in use 3 years, the average cost of maintenance is under 1 cent per square yard per year. The post-war prices double the above figures, except the $1 per square yard for construction.

Bituminous Gravel

As I have been going along, I have included bituminous gravel in my remarks, with few exceptions. Undoubtedly where gravel can be obtained, much better results and stronger roads will result. We have built a good many miles of road in Massachusetts of bituminous gravel and we think very well of them, even for a very great volume of traffic, including quite a number of heavy trucks. We have also resurfaced and widened a great many miles of road, 75 to 100 miles, where we used the old water-bound macadam road as a foundation, when there was 2 or 3 inches of it still left.

Where the traffic is heavy and we are building a bituminous gravel road, we have, of course, put in a foundation of gravel or field stone where the sub-soil was not good. We have then usually put a crusher into the gravel pit and crushed the larger stone, and perhaps field stone as well, and have laid the foundation of broken stone about 4 inches thick, well shaped and thoroughly rolled. On this, we have spread the mixed gravel and oil, so that it would be about 2½ inches thick, after rolling with the steam roller. Even with good soil conditions, where the roads had heavy traffic, we have used either broken stone or gravel in the sub-base, so that when watered and thoroughly rolled by the steam roller, it would be 4 or 5 inches in thickness.

The top course or wearing surface is just a mixture of asphaltic soil of from 90 to 120 penetration, thoroughly mixed with the heated gravel, and spread evenly so that it would be about 2½ inches thick after rolling. A tandem roller seems to be the best for rolling this material, as it can be used while it is hotter without producing depressions like a heavier steam roller. This mixture usually requires about from 20 to 22 gallons of oil to the cubic yard of loose gravel, the oil being measured out.

Eighteen Feet in Width is Needed

These roads should be built at least 18 feet in width, even with good material in the shoulders; with poor material, they should be 19 or 20 feet in width to prevent having the sides cut off. A ¼ inch crown to the foot is better than a ½ inch. We now have a practice of banking all of our corners and curves where that is physically possible and giving them a grade from the outside to the inside of ½ to ¾ of an inch to the foot of width. When we first began the work, we used California asphaltic oil with good results, and since then we have used Texas, Mexican and other asphaltic oils with very good results.

Originally, these roads cost no more, and usually a little less, than water-bound macadam, and they were much more economical to maintain and withstood automobile traffic and motor traffic much better.

They originally cost about 60 cents per square yard, including the broken stone or gravel bottom, but not including grading, foundation or drainage. Last year the cost for the surface ran up from $1.25 to $1.50 per square yard, material, teams and labor having advanced in price.

Traffic

It is hard to predict just what traffic sand and oil roads will withstand. They have now stood for 12 years in reasonably good condition on roads that had 600 to 800 automobiles a day, 47 to 70 2-horse teams a day, and an average of about 38 trucks a day. They have had go over them without any noticeable damage quite a few motor trucks carrying oil or gasoline that would weigh up to 14 tons including truck and load.

The gravel and oil mixed roads, and those that have been resurfaced with gravel and oil, have stood satisfactorily for 6 to 8 years with much heavier traffic than this, especially in trucks. I have in mind one section in particular that was constructed and opened up to traffic leading directly to Camp Devens, where they had a cantonment for about 30,000 soldiers, built during the war. It had some days as many as 700 trucks going to that cantonment, and when they built a very large hospital there, they moved from 30 to 40 lumber trucks, weighing 12 to 13 tons including the load, over that road every day. This made a very heavy traffic indeed for the two years that that road has been built. I think I am safe in saying that that road has never shown any signs of weakness or needed any patching whatever.

Mainly Constructional

East and West—From Coast to Coast

A waterworks system for South Stamford township, Ont., is being considered. This project will require an outlay of $125,000.

City Treasurer Davis of Hamilton reports that the waterworks debenture issue, amounting to $218,300, has been oversubscribed.

A housing commission composed of town manager Armstrong, building inspector Green and Mr. E. W. Mair, has been appointed at Woodstock, N. B.

Mr. G. R. Richer, architect, St. Hyacinthe, Que., is preparing plans for 50 residences for the city council of that city. The estimated cost of these is $250,000.

The Parkdale Concrete Construction Co. has opened an office at 168 Jamieson Ave., Toronto, and are open to take contracts for all forms of concrete work. Mr. C. L. Brooker is manager of the new company.

The plant of the Ontario Cement Co., at Brantford, Ont., is to be moved to Beachville. The work of laying sidings to the new site is going on at the present time and construction of the new plant will be commenced soon.

Messrs. J. Crang & Sons, Toronto, are contemplating the erection of 100 residences on Crang Avenue. It is stated that actual construction will be commenced on these as soon as the city has guaranteed sewer and water connections.

The G. W. V. A. of London, Ont., has appointed a delegation to wait upon the Chamber of Commerce with the request that the latter body furnish a $20,000 bond to cover initial 10 per cent. payments on houses which returned soldiers may desire to purchase from the Housing Commission.

The new water board, which is to take charge of the aqueduct improvements at Montreal, has now been completely organized. Offices have been opened in the Duluth building, where the plans of the aqueduct improvements will be drawn up. Two years will be required to complete the improvements, which will cost $4,500,000, it is estimated.

A site has been secured for the proposed barracks for the Royal Canadian Mounted Police at Ottawa, and plans will be prepared at once as it is desirable to have the buildings ready for occupation before the cold weather sets in. The new buildings, which will be of brick construction with stone trimmings, will provide accommodation for 200 men and 140 horses, and will cost in the neighborhood of $500,000.

It is announced that work will be started immediately on the million dollar plant of the Firestone Tire and Rubber Company of Canada on its Homeside site at Hamilton. The main building will be the first of four proposed units. The foundation is already completed, and the contract calls for the building to be completed and handed over for operation in December. Employment will be provided for about three hundred and fifty hands.

A meeting was held recently in the Board of Trade buliding at Winnipeg, for the purpose of getting under way the organization of a Provincial Safety League. A committee of five was appointed at the meeting to select officers. These officers will be selected from lists submitted by the Employers' Association. Mr. R. B. Morley, of the Canadian National Safety League, explained the methods adopted by the Ontario Safety League in educating the public along the lines of safety. Dr. J. H. Halpenny presided.

Personal

Chief Engineer W. G. Chace and Mr. J. H. Fuertes will represent the Greater Winnipeg Water District at the convention of the American Water Works Association, to be held in Montreal June 21-26.

Mr. J. F. Cameron has been appointed sales manager of the Ontario Gypsum Company at Paris, Ont. He was formerly in charge of the Toronto office of this company. Mr. M. M. Patterson will now look after this branch.

Mr. H. C. Swartz, master mechanic of bridges of the Grand Trunk Railway, with headquarters in St. Thomas, Ont., has been appointed superintendent of bridges and buildings from Toronto to Portland, Maine, with headquarters in Montreal.

Mr. Edward Long, of Messrs. Smith Bros. & Wilson, builders of Regina, was recently elected president of the Regina Builders' Exchange, which position was left vacant by the resignation of Mr. R. J. Lecky on account of pressure of business. Mr. H. G. McVean will take Mr. Long's place as vice-president of the Exchange.

Mr. F. Peden, B.Sc., formerly of the architectural firm of Peden and McLaren, Montreal, and who has for several years past been connected with the engineering staff of The Steel Company of Canada in the capacity of architect, has opened an office at 65 McGill College Avenue. He will resume his practice as architect and constructional engineer.

Mr. M. U. Ferguson, consulting engineer, has opened an office in the Dietrich Block, Galt, Ont. Mr. Ferguson has had extensive railroad engineering experience with the Transcontinental and Grand Trunk railways. He was appointed city engineer of Stratford in 1908, later going to Guelph and St. Thomas, Ont. In 1919 he resigned to go into private consulting practice. He is a graduate of Queen's University and a member of the Engineering Institute of Canada.

Mr. C. J. Brittain, formerly manager of the Winnipeg branch of the Canadian Fairbanks-Morse Co., has been appointed vice-president and general sales manager of the company, with headquarters at Montreal, succeeding C. G. Drinkwater who resigned recently to join the banking firm of Alfred & Co., Ltd. Mr. Kenneth Forbes, of the St. John, N. B., branch, will take Mr. Brittain's place at Winnipeg and will also have charge of the branch, now under construction, at Regina. Other appointments are Mr. Malcolm Cordell to take charge of the Montreal office; Mr. George L. Nile to the Calgary office and Mr. Archibald Turner to the St. John office.

Mr. W. M. Scott, C.E., has been appointed to succeed Mr. R. D. Waugh as chief commissioner of the Greater Winnipeg Water District, and will enter upon his new duties at once. The Board of Commissioners were unanimous in the selection of Mr. Scott for this position. The resignation of Mr. J. H. Ashdown, acting chairman of the Board, has been accepted. He will continue as honorary commissioner of the district. Mr. Scott has had extensive engineering experience, and was at one time town engineer of New Glasgow, N. S. He was engaged by the city of Winnipeg during the years 1906 to 1911 as resident engineer on power development work at Port du Bois, after which he went into private practice in Winnipeg. Among some of the more important works, upon which Mr. Scott has been engaged are: Design and installation of water supply and sanitary systems for Transcona, main extension of the city of Winnipeg power plant, in 1917-18; valuation of the Winnipeg Electric railway properties; reorganization of the Brandon waterworks; consulting in connection with the Kenora, Ont., hydro electric plant; reporting on utilities for Keewatin, Ont., and similar work for private parties.

Obituary

Mr. J. F. Whitson, Government Road Commissioner for Northern Ontario, died recently in Sudbury from heart failure.

Mr. Geo. Baker, railway contractor of St. Thomas, Ont., died recently in that city at the age of 77 years. Mr. Baker had been a resident of St. Thomas for the past fifty years.

Mr. Matthew Warnock, one of Toronto's oldest engineers, died recently at the age of 84 years. Mr. Warnock had been a resident of Toronto for the past 73 years and was connected with the installation of the city's waterworks system.

The death occurred on June 11th at Montreal, of Mr. Kenneth William Blackwell, vice-president of the Canadian Steel Foundries, Ltd., Montreal. Mr. Blackwell was born at Devizes, Wiltshire, Eng., seventy years ago, and came to Canada with his father, the late Thomas E. Blackwell, who was the first general manager of the Grank Trunk Railway. He commenced his career as an apprentice in the mechanical department at the Grank Trunk shops, Montreal. After having held several executive positions with the above company, Mr. Blackwell went into business for himself, manufacturing railway supplies. This business later became known as the Montreal Steel Works, Limited, of which Mr. Blackwell was president and general manager, until it was absorbed by the Canadian Steel Foundries, Ltd., Montreal. He was then appointed vice-president of the Canadian Steel Foundries, which position he held till the time of his death. The late Mr. Blackwell, who was a prominent figure in engineering circles, was a past president of the Canadian Society of Civil Engineers.

Trade Incorporations

Terminal Housing Co., Ltd., with head office at Montreal, capital $100,000.

Gympko Products Co., Ltd., with head office at Montreal, capital $500,000, to manufacture cement, lime, brick, etc.

National Construction Co., Ltd., with head office at Montreal, capital $50,000, to carry on the business of engineers, builders, etc.

Hadley, Evely, Limited, with head office at Montreal, capital $50,000, to carry on the business of engineers and general contractors.

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The American Water Works Association's Montreal Convention

THIS issue of the Contract Record might quite aptly be called a Water Works number, for in this, the first issue following the convention of the American Water Works Association, the greater part of its space is devoted to a report of the proceedings including a number of the best papers read at the convention sessions. Some indication of the importance of the American Water Works Association is provided by a review of the registration figures. With 400 members and associates, exclusive of guests, on the convention roster, it is safe to say that this association is the one organization catering to the needs and problems of the bulk of water works officials of this continent. For the first time in many years the Association saw fit to hold its convention in Canada. There are many Canadians, the number ever increasing, in the organization, and the fact that Canadian water works problems are somewhat different from those on the other side of the line justifies the location of the convention in a Canadian city at this time and will justify its return at frequent intervals in the future.

The holding of the convention in Canada was a significant occasion upon which to organize a Canadian section, and, as reported elsewhere in this issue, preliminary measures were taken to group the Canadian members of the Association together in order to look after their local problems. Perhaps the most outstanding feature of the convention was the recognition of the fact that water works officials can accomplish more far-reaching results than they have accomplished in the past and measures were taken to place the A. W. W. A. on a higher footing, indedendent of the dictates of other organizations but yet co-operating with them for the advance of science and engineering in general and water works problems in particular. Full details of these efforts are reported on subsequent pages.

Housing Experiment, Involving Erection of 6,000 Homes, Provides New Ideas

OF the six thousand houses constructed by the U. S. Housing Corporation the bulk of them consist of 4, 5 or 6 room, 2-storey frame detached houses. Next in number follows the stucco house, then the vitrified tile and finally brick. The selection of materials was governed largely by the rules of the War Industries Board, utilization of local material to avoid transportation, and scarcity of cement. A very considerable number of other types of houses were built, such as the double house, rows of brick houses in blocks, apartment buildings and, occasionally, two-storey flats. As a sales proposition to the individual owner the two-storey five and six-room detached house was in greatest demand. Apartment buildings and flats were satisfactory from the renting viewpoint but did not meet with purchasers among the individual home owners.

The general features of the houses built by the U. S. Housing Corporation and the lessons learned as a result of their construction and disposal were outlined at the National Conference on Concrete House Construction by L. K. Sherman, president of the Corporation. Most of the houses were provided with basements or cellars and generally the foundation walls of the cellars were of monolithic concrete, and in many cases concrete blocks were used. A cement floor was provided. It was found there was much complaint from wet cellars. This was generally remedied by simply banking up the surface of the back filling which had settled around the cellar walls. Concrete block walls for cellars should be plastered on the outside if they are to be as water resisting as the monolithic walls. The specifications called for a lean mixture of concrete for cellar floors. This was a mistake and made trouble from dampness which could have been avoided had a richer mixture been provided. Hot air furnaces were generally installed in the basement for heating the houses.

Profit by Experience

"In this Government housing experiment," Mr. Sherman states, "we have learned to do many things; we have also learned, what was still more valuable, things not to do. We have learned that the success-

No. 29.

Canada's Engineers—Geo. G. Powell

Mr. George Powell, the deputy city engineer of Toronto, Ont., was born and educated in Toronto, and has been connected in an engineering capacity with the city of Toronto for the past fifteen years. He graduated from the School of Practical Science, Toronto, in 1902 and took a post graduate course in 1903. During his vacations he worked with the city as rodman, inspector and draughtsman. Following his graduation, Mr. Powell joined the Canadian Niagara Power Co. as inspector of pipe in the foundry of the United States Cast Iron Pipe and Foundry Co. A year later he went to the Allis-Chalmers shops at Milwaukee doing similar work for the same company. In August, 1904, he left the employ of the Canadian Niagara Power Co., and came to Toronto to work with the Constructing and Paving Co. with which firm he remained until 1905. With this company he acted in the capacity of assistant to the general manager. Early in 1906 Mr. Powell joined the Works Department of the city of Toronto as inspector of cast iron work and two months later was appointed assistant engineer in the roadway section in charge of day labor work. In 1910 he became principal assistant engineer in the roadway section and in 1913 he was promoted to deputy city engineer which position he has filled to date. During his connection with the city Mr. Powell's work has included the building of large relief sewers, large paving contracts, new filtration plant, high level bridge at Wilton Avenue and the Bloor Street viaduct. He has been a member of the Engineering Institute of Canada since 1913.

Mr. George G. Powell

tul type of house varies by localities. We have learned that proper town planning and planting can increase the selling value of the house more than any other dollar of investment. We have also learned that the idea of some town planners in omitting alleys and providing unduly wide lots is a physical and financial mistake. We have learned that plumbing is unnecesarily (from $50 to $100 per house) expensive and that it is caused by many municipal plumbing codes which have been established by selfish interests. We have learned that standardized houses can be built which will not look standardized. The selection of a housing site is often governed more by the probable cost of public utilities than it is by the first cost of land. We have learned, but we have not successfully taught our tenants, that rents include many things beside profit to the owners. In general it will amount to about 13 per cent per annum of the value of the property as follows.

Maintenance	2 %
Taxes	1.5
Insurance	.3
Depreciation	2.5
General Expense	.5
Vacancies	1.2
Interest	5
Total	13.0%

Competition With Pre-War Houses

"The new house of today has to compete with the house built in pre-war times. The rental of these houses has increased perhaps 20 to 30 per cent. This represents a satisfactory income to the owner of the pre-war property. An entirely different situation exists with respect to the owner renting a house built in 1919. A 30 per cent increase on 1913 costs will not bring the owner of a new building a sufficient return when the new owner has to compete with the owners of property built before the war.

"In many places in the country the housing shortage is so acute that new buildings are readily rented or sold at today's prices. The average builder of today has to adopt the most economical and efficient procedure in collective housing construction, standardization, and the providing for conveniences and artistic arrangements, so that the added attractiveness will invite the occupant in spite of the higher rental or cost."

Refined Tar Specifications

Refined tars have recently become more or less standardized and specifications often call for very similar materials for the different classes of work. The points now generally covered in a specification are the specific gravity, viscosity, or melting point, free carbon and distillation. The viscosity or melting point is a very important point in refined tars and should be very carefully specified. It is customary to specify the viscosity for cold application by the viscosity of 60 deg. C. and for hot surface application at 100 deg. C.

Convention of Water Works Officials in Montreal

Fortieth Annual Meeting of American Water Works Association—Canadian Section Formed—To Promote the Formulation of Standards in All Lines of Water Works Design and Operation—A Condensed Review of the Proceedings with Abstracts from Some of the Best Papers

OF direct interest to Canadian water works engineers and superintendents was the formation of a Canadian section of the American Water Works Association during the latter's fortieth annual convention in Montreal from June 21 to 25. For the first time in many years this association—the premier organization of its kind on the continent—met in a Canadian city and it was an especially fitting occasion for the Canadian members to launch out on a more extended program of development than has hitherto been possible. The number of Canadian water works officials in the organization has steadily increased, to such an extent, indeed, that many of the Canadian members have felt that it should be possible to derive more benefit than is secured through the once-a-year national convention. For this reason a number of the leading Canadian water works men were ready to suggest the formation of a Canadian section, prepared to take its place alongside the existing six sections in furthering the local needs of their respective members

The suggestion met with immediate response and at the conclusion of the afternoon session of Tuesday, June 22, an initiation meeting appointed officers for the first year of the branch's existence. By the unanimous appointment, as chairman, of Alex. Milne, superintendent of the water works department of St. Catharines, Ont., the branch has picked out a leader who is not only a widely experienced water works official, but also an enthusiastic advocate of the policy and purposes of the American Water Works Association, who has kept in close touch with its affairs and has been keenly interested in many of its branch meetings.

Officers of the Canadian Branch

Other officers who will guide the affairs of the Canadian branch during the ensuing year are: F. H. Pitcher, managing director and chief engineer, Montreal Water & Power Co., vice-chairman; H. G. Hunter, Montreal, secretary-treasurer; R. J. Dobbin, of the Peterboro, Ont., water works department, Arthur Surveyor, consulting engineer, Montreal, and R. C. Harris, commissioner of works, Toronto, trustees for one, two and three years respectively. At the annual meeting there was also appointed a committee, consisting of W. H. Hammond, Lindsay, Ont., MacH. McCrady, Montreal, J. J. Salmond, Toronto, and C. W. Schiedel, Waterloo, Ont., to draft a suitable constitution for the branch, after investigation of those of the existing branches.

The formation of the Canadian section was, in a way, an answer to the plea of president C. E. Davis, who, in his annual address, urged sectionalization as a means of bringing the A. W. W. A. closer to the public. More extended reference to president Davis' address is given below, but suffice it to state at this point that one of the major thoughts presented was the development of sections to increase the value of the organization. "The existing sections must be strengthened, new sections must be created," stated Mr. Davis, "all with a view to a final amalgamation in one central organization of the entire water works interests of the country. This process carried to a logical end will not destroy our existing organization, but, perhaps, change its character, opening up to it a much wider field of usefulness along somewhat different lines."

To Promote Standards of Materials and Practices

Another matter of far-reaching effect upon which the association took a definite stand was the development of its opportunity to bring about standardization in the water works field. Mr. Davis, in his annual address, has struck the keynote in this respect "Water works operators," he claimed, "must determine for themselves whether they propose to accept, without a voice in the matter, standards which may be imposed upon them from the outside, or whether they propose to set up certain standards for themselves which outside parties must of necessity accept because of the authority behind the conclusions of the water works operator. If the latter is to be the case, the water works men must take the initiative, otherwise it will be taken from them. If the water works man does not lead, he must follow. Standardization of metals, chemicals and all varieties of water works supplies has been left too much to the care of other societies who have not necessarily had the welfare of the water works fraternity at heart. Some progress along this line has been made in the matter of formulating specifications for cast iron pipe. The committee dealing with this matter has been working for many years and has obtained results that are recognized as most valuable by even other organizations than the A. W. W. A. This good work must not stop here, however, it must be developed along the line of every supply and material entering into water works construction, operation and management."

Specific means for dealing with this program were later formulated in a resolution of Col. George A. Johnson, who proposed that a council of standardization, comprising five active members, be formed with power to create sub-committees to investigate and promulgate standards of water analyses and in a general way, standards of all materials and appliances entering into the water works business. There are many subjects upon which standards are necessary, which standards are within the rightful sphere of the A. W. W. A. to formulate; for example, analysis of coal, oil, sand, cement; standards of permissible pollution for domestic supplies and for industrial water; standards for the design and equipment of purification plants. These are standards that this council can determine for the benefit of all men of whatever organization, who are interested in water works design or operation. Col. Johnson's resolution was adopted, but not without discussion on the part of one or two members who felt that perhaps the best way of undertaking the formulation of standards was by cooperation with the great national engineering bodies which have already done much work along this line, through a joint standards committee.

E.I.C. Welcome A.W.W.A.

The Engineering Institute of Canada took the opportunity of welcoming the 40th convention of the American Water Works Association to Montreal and through its president, Commissioner Ross of Montreal, placed all its facilities at the disposal of the visiting delegates. Mr. Ross referred to the response which water works men had displayed in the water strike at Montreal last winter. If it had not been for the interest which these men exhibited, the city might have been on the verge of serious inconvenience and possible calamity. Mayor Martin of Montreal in welcoming the association to the city, also referred to the water strike and voiced his appreciation of the aims and objects which the A. W. W. A. had in view and of the significance of water works operation in municipal administration.

Montreal's Water Supply under Discussion

On Tuesday, June 22, the association got its convention off to a good start with an initial attendance sufficient to indicate that there would be a very numerous representation of water works men from all parts of the continent. Later in the week the official records showed the registration to be 632, comprising 267 active members, 135 associate members and 230 guests, including the ladies.

Quite naturally the water supplies and water problems of the city of Montreal and the province of Quebec occupied the attention of the larger part of the first day's proceedings. Mr. F. H. Pitcher, managing director and chief engineer of the Montreal Water & Power Co., described the plant of that company which supplies about one-third of Montreal and a number of adjoining municipalities. Mr. Pitcher outlined the progressive development of the company's works and the difficulties it had to contend with in supplying water to municipalities ranged on vastly different levels. Considerable interest attached to the author's delineation of frost troubles, as the extremes of cold have rendered the provision of a continuous service difficult and in this regard it was Mr. Pitcher's statement that the practice of clearing the protective covering of snow from the streets proved detrimental and costly to the maintenance of a satisfactory water supply. The municipally owned water works supplying the remaining two-thirds of the city of Montreal were described in a paper by Thos. W. Lesage; this paper is reproduced in slightly condensed form in this issue. Mr. James O. Meadows, sanitary engineer of the Montreal Water & Power Co., outlined local experience in the manufacture of filter alum by the Hoover process, which had resulted in a very distinct saving in the cost of supplying this material. This paper is also reprinted on a following page.

Quebec City's Gravity Supply

The paper by T. P. Lafreniere, sanitary engineer of the Superior Board of Health, noted on the program as "Water Supply Problems in the Province of Quebec," developed into a statistical outline of the nature of the supplies in the province. It is reprinted practically in full elsewhere. Considerable interest was displayed in an impromptu address by C. P. Casgrain, manager of the Quebec City water works, who described the gravity supply of that city. Water is derived from Lake St. Charles, 7 miles north of the city, and is fed by gravity through an 18 in., a 30 in., and a 40 in. pipe. The supply is not metered and the rates are 1 per cent. on real property, 10c per thousand gallons for charitable institutions and 60c per thousand gallons for educational institutions. Mr. Casgrain stated that the reservoir capacity of Lake St. Charles is sufficient to supply the needs of a city of 500,000 and on this account the water supply was so abundant that there was no objection to Quebec citizens allowing the water to run during the cold weather to avoid the possibility of freezing. In fact, this procedure was urged as it proved a very potent factor in reducing the number of necessary thaw-outs. The supply was characterized by Mr. Casgrain as absolutely clear except in the spring thaws and heavy rains when some sediment was evident. The fact that there is no typhoid death rate in Quebec testifies to the purity of the water. Mr. Casgrain was asked if the sediment was sufficient to deposit in the mains to a detrimental extent, but he replied that the pipes were very readily flushed on account of the high pressure which is available.

On the first day the convention was advised of the result of the letter ballot for the election of officers. These were: president, Beekman C. Little, superintendent of the Rochester Bureau of Water; vice-president, Edward Bartow, Urbana, Ill.; treasurer, James M. Caird, Troy, N. Y.; trustee for 2nd district, Harry F. Huy, Buffalo; trustee for 5th district, Robert J. Harding, San Antonio, Texas.

New Method of Nominating Officers

An important amendment to the constitution was put into effect by which members of the Nominating Committee are selected at the convention in time to permit this committee to make a slate while still at the convention. This has been done to eliminate the costly expense of bringing the nominating committee together at some central point for the purpose of selecting candidates. The slate thus selected by the nominating committee, together with other names suggested according to constitution, will then be submitted to the members by letter ballot prior to the next convention. A suggested amendment to make the secretary an elective officer was rejected, as it was felt that a paid official should hold office at the discretion of the executive. In accordance with the new method of nomination, the nominating committee was selected and ordered to suggest before the close of the convention a slate for the year 1922.

Some reference has already been made to the president's address, which was delivered at the session of Tuesday, June 22. It was replete with excellent ideas and it is gratifying to note that many of these were taken up and acted upon. A condensed report of his address is contained on the following page.

At the evening session on June 22, three papers were read, the first paper being "Water Works Experiences," by Beekman C. Little. The second paper on "Economical Features of Pumping Station Operation" by Leonard A. Day, showed how coal consumption at St. Louis water works plant had been very materially reduced by scientific adjustment of boiler and grates. A very intricate and interesting piece of foundation work was described in a paper by James B. Wilson, which was illustrated. The work in question was a foundation of the new pump house at Louisville, where the inaccessibility of rock, the closeness of the river and the proximity of existing structures made conditions especially difficult.

Winnipeg Aqueduct

The water supply of Winnipeg formed the topic of discussion at the afternoon session of Wednesday, June 23. The engineering aspect of this great work, costing $15,000,000, was outlined in the address by the consulting engineer, Mr. James H. Fuertes, while the construction features of the project were described by W. G. Chace, chief engineer of the Greater Winnipeg Water District. The Contract Record has described this work very profusely and there is no need of giving the papers of Messrs. Fuertes and Chace in great detail. The effect of alkali soils was discussed and suggested remedial measures were outlined. These comprised undermining the aqueduct and backfilling with gravel, thoroughly underdrained. Mr. Fuertes intimated that the aqueduct had been designed on the assumption that it would crack through settlement. Foundation conditions were such that no data was available and it was considered more economical to assume that cracks would occur than to attempt to build foundations sufficiently stable to prevent cracking. Repairs to these cracks have been readily made without proving detrimental to the aqueduct in any way. Some light was thrown on the effect of frost on the aqueduct, the depth of cover being often insufficient to prevent penetration of frost to the structure itself. In regard to the temperature of the water supply, Mr. Fuertes stated that the temperature at Winnipeg was but a degree or so different from the temperature at Indian Bay inlet, 100 miles away. This means that in the summer time the water is frequently insipid, while in the winter time it is close to freezing point.

Following these papers a number of reports were read. The Illinois, Iowa and Minnesota sections reported their section activities. The Finance Committee, through its chairman, Col. George A. Johnson, reviewed the financial standing of the association and presented the budget for the year 1921. It recommended allowances for the ensuing year of $15,350, and to take care of this outlay, the committee suggested an increase in the dues of corporate members to $10 a year, those of associate members to $15 a year, those of active members to $6 a year. On this feature of the report, some lively discussion took place, with the final result that the opinion of the members at large is to be consulted with regard to the raising of dues, that action being necessarily allowed only by change of constitution. However, the general consensus of the convention was that the increase was quite within reason. The Finance Committee report indicates a balance of nearly $2,400 in the bank and a net loss on the year's operations of $147. A permanent investment fund of $12,000 is now on hand. This report was adopted.

The report of the association's representative on the American Electrolysis Committee was also read and approved.

Lively bidding for the seat of next year's convention was waged between the advocates of Cleveland, Baltimore and Kansas City, with the result that after two ballots Cleveland was selected.

In the forenoon of Wednesday, the delegates were given a trip through the Lachine Rapids, as guests of the Water Works Manufacturers' Association. A number of other entertainment features were also provided with special features for the lady guests.

On Thursday, besides a session for the Chemical and Bacteriological Section, a session was held at which various problems of interest to superintendents were discussed. In the evening, three papers were read, two of which, by G. W. Fuller and Leonard Metcalf, are abstracted in subsequent pages.

Water Works Men Must Take Initiative

Retiring President, Carleton E. Davis, Urges Members of A.W.W.A. to Work Out Their Own Standards of Practice and Procedure—Comprehensive Organization Will Strengthen and Enhance the Value of the Association

THE majority of our members are restrained in their activities by regulations imposed upon them by public service bodies, or by the restrictions of legislative enactments, or by the limitations of city laws and ordinances. Many of these restraints are irksome, and are not accepted calmly or without chafing under the restraint. Along the field of organization work we have a relatively free hand to organize and develop. We have an opportunity to demonstrate that the water works engineer and operator is a capable organizer, and, when given the opportunity, can conduct his own affairs with efficiency, and at the same time with due regard for the interests and welfare of the public, with an eye to the future and an alertness for the present.

It is stated on good authority that the investment in water works represents the largest total in the entire field of comparable utilities. Water works officials know that their plants, of all utilities, supply one universally indispensable commodity—vital for human existence and basic for all community life. We have common interests, and that we are grasping for methods of expressing this interest by working together for a common end is shown by the number of water works organizations. The next step forward is the affiliation of the several organizations to handle matters of mutual interest with the power and weight that come from large numbers, unity of purpose and harmony of ideas.

Organization is Needed

Organization is the dominant note heard throughout engineering and allied fields at the present time. The American Water Works Association, through accredited representatives, recently attended a National Council in Washington of organizations concerned with public utilities like our own, seeking to co-operate, offensively and defensively, in matters vitally affecting the interests, personal and official, of their members. Whatever may be the final outcome of such efforts, or whatever may be the path the council of affiliated societies may elect to follow, self-respect demands that the water works of the country shall be able to speak as a unit at such councils and with the weight attaching to full and not partial numbers.

We are holding this convention in Canada, the home of a large number of our active, corporate and associate members. I feel confident that the further development of the principle underlying the sections will tend to stimulate Canadian interests in the same measure that I believe it will tend to awaken interest in other portions of the continent, irrespective of geographical location. Water works problems are physical and material, social and political. The first two mentioned are common, irrespective of locality. The last two mentioned depend upon the human element, and human nature has common characteristics the world over. Water works men on this continent have underlying interests and will continue to co-operate in the future as they have in the past.

We do not realize our strength because we have never attempted to exert it as a unit. Unorganized society is helpless against attacks and demands of relatively small but effective, because organized, groups working together. The existing lack of cohesion among water works men places them relatively in the position of the present unorganized public, powerful but helpless because of its inability to work together. Sometimes among our own ranks we hear references to the so-called little fellow and the big fellow. Each one of our members has something to give and something to receive. The perpetuation of the false idea of big and little, great and small, is harmful because it is based on wrong premises, is unreal and exists only in the imagination.

Water Works Men Must Make Their Own Standards

The public water supplies of the country are developing from year to year, meeting the growth of the country. They present highly complex technical and engineering problems. The period of outside regulation has been with us for some time past and is increasing. Local, state and national health organizations are charged with functions relating to water supplies which are sometimes arbitrary and absolute. Public service commissions are given or assume increasing authority from year to year. Water works operators must determine for themselves whether they propose to accept, without a voice in the matter, standards which may be imposed upon them from the outside, or whether they propose to set up certain standards for themselves which outside bodies must of necessity accept because of the authority behind the conclusions of the water works operator. If the latter is to be the case, the water works men must take the initiative; otherwise it will be taken from them. If the water works men do not lead, they must follow.

Standards of practice and procedure must be done through committees and committee work will become of increasing importance. The path of the committees must be smoothed as much as possible. When the authority for committee work can emanate from a central body, representative of all the water works of the country, when co-operation comes logically and as a matter of course and not under option of possible rival organizations as at present, the desired end will be in sight.

The Water Supply Situation in Quebec Province

86 Per Cent. of Population Served by Waterworks Derive Supply from Rivers — One Municipality Out of Three Does Not Own Its Plant—Extent of Purification —Board of Health Has Wide Powers Over the Control of Works

By Theo. J. Lafreniere, Sanitary Engineer, Superior Board of Health

QUEBEC has a population distributed as follows: 18 cities. population, 1,101,200; 81 towns, 178,400; 220 villages, 158,400; 887 rural municipalities, 942,000; total, 2,380,000. The population of the cities and towns is thus 53.7 per cent. of the total population, leaving 46.3 per cent. as rural population.

There are 440 water supplies in the province, but half of them are small, serving only a few houses, in some cases. According to the data available, 59 per cent. of the population of the province is served by waterworks, and 41 per cent. use shallow or tubular wells.

A special study of the water supplies of cities, towns and villages with a population of over 500 inhabitants shows that there are 230 such municipalities, and 192 of them, with a combined population of 1.383,700 have waterworks. It is interesting to note how the various sources of supply have been utilized.

Sources of Water Supplies in Quebec

Source	No. of works	Per Cent of total Number	Population	Per Cent of Population
Rivers	97	50.5	1,192,512	86.2
Lakes	20	10.4	52,879	3.8
Springs or wells . .	75	39.1	138,338	10.0
Total	192	100.0	1,383,729	100.0

River Sources are in Majority

Of this population 86 per cent is supplied with river water, a very high percentage. This is due to the fact that, with the exception of four, all the cities use river water. When the waterworks were installed some 40 years years ago, the rivers were fairly clean, and the necessity of pure water was not as well understood as it is to-day. The towns were built on the shores of large rivers offering a supply of good appearance, and consequently the rivers were used in preference to more distant sources of supply.

The lakes, on the other hand, have not been fully utilized when you consider that only 3.8 per cent. of the population is supplied from such a source. The numerous lakes all over the province offer a first-class supply; unfortunately the lakes are not near the large centres of population. Twenty waterworks use lake water, but they serve mostly small towns.

The water-bearing formations in the province are not well known, the available information on the subject being very meagre. Hence 10 per cent. only of the population is supplied with underground water. With few exceptions, the 75 waterworks in this class use springs originating at the outcrop of a porous stratum underlain by an impervious one. Such supplies are usually possible for small towns only. Several artesian wells have been sunk in the last few years with remarkable success; the disadvantage of the source of supply is that, unless an extensive water-bearing formation is reached the yield of the wells is uncertain and variable.

Large Number of Private Waterworks

A great number of municipalities do not own their water supply, but with the exception of a part of the city of Montreal and two adjoining cities, this occurs in small towns and villages only.

Ownership of Water Supplies in Quebec

Ownership	No. of works	Per Cent of total Number	Population	Per Cent of Population
Municipal.	124	64.6	1,046,260	75.6
Private.	68	35.4	337,469	24.4
Total.	192	100.0	1,383,729	100.0

One municipality out of three does not own its water supply. The cost of waterworks is high and after the construction of same the small town finds that most of its borrowing power has been used by the waterworks and that practically nothing is left for other improvements. Consequently, in order to have both, the waterworks and the necessary funds for other improvements, the municipality grants a franchise for the waterworks, which is a revenue-producing utility. This practice is not to be encouraged as in most cases the system does not provide for adequate fire protection, and eventually the municipality has to buy the system and practically build it new.

Since the creation of a department of municipal affairs the limit on borrowing power has been removed but the necessary majority to sanction a by-law has been increased. Hence it is hoped that the number of municipal waterworks will increase.

If we examine the use made of the various sources of supplies by the municipal or private corporations we find that in both cases over 85 per cent. of the population is supplied with river water. Two private waterworks only use lake water, while forty small supplies are derived from springs and wells.

Municipal Waterworks

Source	No. of works	Per Cent of total Number	Population	Per Cent of Population
Rivers..	71	57.3	903,778	86.4
Lakes..	18	14.5	49,929	4.8
Springs and wells .	35	28.2	92,523	8.8
Total.	124	100.0	1,046,260	100.0

Private Waterworks

Source	No. of works	Per Cent of total Number	Population	Per Cent of Population
Rivers	26	38.2	288,734	85.5
Lakes.	2	3.0	2,950	0.9
Springs and wells .	40	58.8	45,745	13.6
Total	68	100.0	337,469	100.0

Extent of Water Treatment

We have seen that 86 per cent. of the population served by waterworks is supplied with river water which is usually unsafe for domestic use. However, all of this water is not consumed without previous treatment. In the province to-day 858,000 people are supplied with filtered river water, and 170,000 with chlorinated water, giving a total of 1,028,000 people using treated water. This number represents 86 per cent. of the population using river water. Six municipalities, with a population of 60,000 people, now chlorinating their supply, have been ordered by the Superior Board of Health to install purification works.

Treatment of River Waters

Treatment	Number of Installations	Population Served
Filtration	29	860,000
Chlorination..	15	170,000
No. treatment	53	163,000
Total	97	1,193,000

Lake water and underground water being naturally good, it would seem that our water question is practically solved, unhappily. it is not so. The great percentage of the population is protected against water-borne diseases, but the remaining 14 per cent. is divided among many small municipalities, which will be harder to reach than the larger towns.

It appears from the above table that 53 towns with a combined population of 163,000 inhabitants, use river water without any previous treatment. The streams from which these supplies are derived are more or less contaminated. Moreover, approximately 20 per cent. of the towns supplied by underground water have a supplementary water intake in a nearby stream for fire purposes.

Powers of Superior Board of Health

Now the Quebec Public Health Act of 1915 gives to the Superior Board of Health extensive powers concerning the control of water supplies. All new waterworks must be approved by the Board before being installed. Furthermore, the Board has the right to make investigations and to order purification works where needed or to order the causes of pollution to be romoved. When the supply is owned by a private corporation the Quebec Public Utilities' Commission decides whether the cost of the improvements shall be paid by the private corporation or the municipality, and in what proportion. To comply with the orders of the Board, the municipal corporation is allowed to borrow the necessary amount without being obliged to submit the by-law to its ratepayers, and the Board has the right to have the improvements done at the expense of the municipality when the latter refuses to submit to the order.

Even with these extensive powers, however, the improvements necessary to the water supplies of the small towns above mentioned may not easily be obtained because of the execessive cost of materials and the high rate of interest charged for municipal loans. The difficulty thus reduces to the financial question of how to obtain money for these small towns at a reasonable interest rate.

This difficulty the Board of Health hopes to overcome by means of a project, now under consideration, whereby small municipalities may borrow from the province, at a low rate, the funds required for the needed improvements. If, as is expected, the Legislature sanctions such a project this most important remaining problem of water supplies in the province of Quebec—the problem of the small town supply—may possibly be solved.

(Discussion on this paper appears on page 640)

Building permits issued at Regina, Sask., during the month of May totalled $324,675 in value, or practically double the figure of $178,880 for the same month last year. The total for the first five months of the present year is $1,395,250.

The Municipal Water Supply of Montreal

Two-Thirds of the City Served by the Civic Sytsem Which Pumped During 1919 an Average of 65,000,000 Gallons Per Day—Per Capita Consumption was 145 Gallons—Booster Stations for Higher Levels—2 Per Cent. of Services are Metered

By Thomas W. Lesage, Superintendent, Montreal Waterworks

THERE are in Montreal two water supply systems, the city municipal system supplying the main portion of the city to the extent of about two-thirds of the above population and a private water company, the Montreal Water & Power Company supplying about one-third of the population, besides two towns on the outside limits of the city.

The city's water supply is drawn from the St. Lawrence River about a mile above the Lachine Rapids and at a distance of about five miles from the city. The supply intake is 1200 feet from shore, the river at this point being about three-quarters of a mile wide. The water is brought down by gravity a distance of 5¼ miles to the main pumping station through a covered conduit, circular in shape with flattened invert, practically of 8½ feet in diameter, having a capacity at the lowest stages of the river, of 80 million imperial gallons per day.

At the lower end, and to the south of this supply conduit is the filtration plant, to which the water is led by gravity. Raised by low lift pumps to the pre-filters, the water flows thence to the final filter beds and the filtered water reservoir, being re-pumped from there to the level of the suction well feeding the main supply pumps. The filtration plant of 50 million imperial gallons capacity at present filters only about three-fourths of the water supplied the pumps. Plans for its enlargement are under way. The whole supply is, however, sterilized by hypochlorite.

Equipment of Main Pumping Station

The main or low level pumping station situated at the end of the supply conduit, near the south western limits of the city has a pumping capacity of 108 million imperial gallons per day, by means of eight steam pumping engines as follows:

Pumping engines Nos. 1, 2 & 4 of the horizontal reciprocating type, Worthington Duplex high duty steam pumping engines with combined capacity of 30 m.g.d.

Pumping engines Nos. 3, 5, 6 & 7 of the centrifugal type, high lift pumps, direct connected to high speed vertical triple expansion engines working at 350 r.p.m. with combined capacity of 48 m.g.d.

Pumping engine No. 8 DeLaval centrifugal high lift pump geared to steam turbine, with capacity of 30 m.g.d.

Total of 8 pumps with daily capacity in imp. gals. of 108 millions.

The oldest of these pumps Nos. 1 and 2, installed in 1886 and 1893 respectively, are the least efficient of the pumping plant and are to be replaced within a year by two 30 million gallon electric-driven high-lift centrifugal pumps now contracted for. No. 4 pump installed in 1905 is of more modern type with a trial duty test of about 160 million foot pounds. The four high-lift centrifugal pumps driven by direct connection to triple expansion vertical engines of enclosed type, at 350 r.p.m., installed from 1909 to 1913, are representative of the change from the reciprocating to the high lift centrifugal type of water works pumping engines. Their efficiency rating on trial was from 108 to 114 million foot pounds duty. These pumps discharge the water through the force mains against the reservoir head and into the city's distribution system. There are six pumping force mains; one of 36 inches, two of 30 inches and three of 24 inches. The others connect more directly and feed into the distributing service pipes throughout the city as well as being indirectly connected with the reservoir. Thus the system may be said to be direct pumping with regulation of pressure due to the head from the reservoir of limited capacity.

The main reservoir, McTavish reservoir, situated about 1½ miles from the pumping station, has its water surface at elevation 204 above low-water level of the harbor. Its capacity is 37 million imperial gallons or about four-sevenths of last year's average daily consumption of 65 million imperial gallons. The pressure head due to the McTavish reservoir supplies the system up to about elevation 130 above the harbor, furnishing water pressures of 80 lbs. in the pipes of the down-town district to 35 lbs. at the level of Sherbrooke street from which the slope of Mount Royal begins.

High Level System

Above Sherbrooke street and generally in that area spread out around the eastern slope of the mountain extends the high level system. The high level or Peel street reservoir situated on the mountain slope has its water surface elevation at 422 feet above the harbor. Its capacity is 1¾ million imperial gallons. The high level system is supplied by re-pumping the water from the McTavish reservoir level. There are two pumping stations for this purpose: McTavish street and Papineau Ave. stations. The pumping is done by high-lift centrifugal electric-driven pumps, with two units, one of 6 and one of 5 million imperial gallons in each station. The average daily consumption for 1919 of the high level system was 11.9 million imperial gallons.

Upper Level System

To provide for water supply to the still higher residential district, the Upper level system was installed about nine years ago. This consists of a covered reservoir of 200,000 imperial gallons capacity hollowed out in the Mount Royal Park at elevation 550 above the harbor. The water is re-pumped from the high level system to this upper level by a duplicate set of electrically driven units each of a capacity of 150,000 imperial gallons per day.

To supply the high levels of Notre Dame de Grace ward, there is also provided a booster pumping station to re-pump the water from the main low level system. The pumping is done against the pressure head due to three tanks of 100,000 gals. capacity and erected on the highest point in the ward at elevation 382 above the harbor. The daily average consumption is about 2½ million imperial gallons.

The town of Cartierville, annexed in 1917, has its own water supply plant of one million gallons capacity, consisting of electric-driven centrifugal pumps and filtration plants, this independent supply being taken from the Black River.

The former town of Emard, annexed in 1910, has also an independent supply, the water being taken from the city's main supply conduit and pumped, under contract, by an outside company. The average daily consumption is about 935,000 imperial gallons.

Water Distribution System

The city's distribution system of piping comprises 497.6 miles of pipes from 4 inches to 36 inches in diameter. Of this total, the 8 in., 10 in., and 12 in. pipes make up about 332 miles or about two-thirds of the whole. For many years past the principle has been adopted that no pipe less than 8 in. diameter shall be laid for distribution service in the streets of the city. The 4 and 6 in. pipes are mostly in outside wards annexed to the city within the past ten years. The smaller pipes in the system are generally well supported at intersecting streets by pipe of larger diameter, especially in the main portion of the city, thus providing for several effective hose streams in case of fire without the use of fire engines.

Filtration Plant

In the city plant a double system of filtration is carried out, that is, the water is first passed through roughing pre-filters before being passed through the regular filter sand beds. The raw water is taken from the main supply conduit through a 9 ft. circular conduit about 1200 feet from the lower end of the supply conduit and is lifted by motor- driven low-lift pumps to the pre-filters.

There are 16 covered pre-filters each of a net filtering area of 1200 sq. ft. The water passes through the pre-filters at a nominal rate of 115 mil, imp. gals. per acre per day. From the pre-filters the water flows by gravity to the final filters. There are 16 final filter covered beds with a total area of 6 acres. The water passes through the final filters at a normal rate of 8½ mil. imp. gals. per acre per day and collects in the covered filtered water reservoir which has a capacity of 6 mil. imp. gals.

The filter plant as already stated has a normal capacity of but 50 mil. imp. gals. per day, and as the water consumption has reached 65 to 70 millions it is necessary to enlarge it and plans are under way for same, the land being available for such extension.

Quality of the Water

The water drawn through the intake, 1200 feet from shore at the head of the Lachine Rapids, is mainly of St. Lawrence River origin. However, as the Ottawa River joins the St. Lawrence at the head of Montreal Island its waters follow the shore line, inside the intake and at times the supply contains varying proportions of Ottawa water depending on seasonal and weather conditions. The largest percentage of Ottawa water occurs in May and its presence is always indicated to the consumer by its characteristic brown color, but except in the months of April or May when it carries a high turbidity, this is its only objectionable feature.

The water of the St. Lawrence from the standpoint of household use, as tapped by the intake 1200 feet from shore is superior in every respect to that found further inshore, and the bacterial content, turbidity and color increases as the shore is approached.

Water Consumption

The average daily consumption for 1919 was 65,046,000 imperial gallons and the estimated population served by the city's system was 449,000—a per capita daily consumption of 145 imperial gallons. In the years from 1900 to 1919 the average daily consumption has increased from 20,412 millions to 65,046 millions that is 44,634 million gallons or 218 per cent. In the same period the population served has increased from 266,000 to 449,000, that is, 183,000 equal to 69 per cent.

From 1900 to 1910 the average rate of yearly increase of consumption was 1.822 million gallons per day, an average of about 6.6 per cent. increase each year. From 1910 to 1914 the average yearly rate of increase was 4.27 million gallons per day, or an average increase each year of 9.6 per cent. over the preceding year.

In 1914-15-16 the rate of consumption remained stationary at about 55½ million gallons per day, but in 1917-18, for two years, it rose again at a rate of increase of 4.76 million gallons per day per year, and in 1918 and 1919 remained stationary at about 65 million gallons for each year.

The population served from 1912 to 1919 has increased 110,000, that is, from 339,000 to 449,000 or an increase of 32.6 per cent.

The consumption per capita between 1910 and 1914 jumped from 115½ gallons in 1910 to 150 gallons in 1914 and it has been between 140 and 150 practically since 1912.

It is difficult to explain this increased rate of consumption of water in the past ten years. It is no doubt partly due to more ample use of water in modern house fittings but it may also be explained by the greater use in manufacturing establishments and the greater quantities required for municipal purposes, public baths, parks and squares and the flushing of sewers and streets, all of which have greatly increased in the past ten years.

Water Rates and Meters

The charge for water to the citizens is met by a municipal tax on all householders of 6 per cent. on the assessed rental. This tax is commonly called the water rates, but it does not necessarily represent the cost of the water service. This flat rate method of charging for water is not conducive to economy from the operating point of view, as the citizens have no direct inducement to economize on water and it calls for more rapid house to house inspection of fixtures if wastage is to be controlled.

Meters are only placed in certain commercial and manufacturing establishments and other institutions where the use of water requires control against wastage. There are about 85,000 water services and only 1,668 meters in use; that is, less than 2 per cent. of services are metered.

The meter rate regardless of the quantity of water used is $1.15 per 1,000 cub. ft. or about 18½ cents per 1,000 imperial gallons. For fire protection no charge is made for water used. The proprietor may install fire protection services of 4 in., 6 in. or 8 in. on his premises for sprinkler or stand pipes supply by paying the whole cost of laying the service, and excepting in certain manufacturing establishments which are all by meter, no charge is made for the water used for this service.

At present the city has under consideration many extensions to its water works plant. Two thirty million gallon electrically driven pumps are contracted for these to be delivered within a year. Plans are being prepared for enlarging the filtration plant to a capacity of 130 million gallons per day. To supplement the present limited conduit supply of 80 millions the aqueduct is to be prepared to convey additional water and also furnish power in a modified form. Additional reservoir capacity and an increase in the number of force mains are also planned in the near future.

Manufacture of Filter Alum at Montreal

Experience of the Montreal Water and Power Co.—Cost Works Out at $28.64 Per Ton Against $55 for Commercial Product—Nearly $50,000 Saved in Two Years

By James O. Meadows, Sanitary Engineer, Montreal Water and Power Co.

THE filter alum manufacturing plants of Columbus, Ohio, Springfield, Mass., Trenton, N. J., and Omaha, Neb., have been described in detail in the Engineering News of Jan. 4th and 11th, 1917, and as the general make-up of all Hoover Process alum plants is somewhat similar, it is not intended to describe the plant of the Montreal Water and Power Co. in detail but rather to give the experience of the past four years operation. The alum plant was installed with the idea of keeping the capital outlay as low as possible consistent with proper operation, because at the time it was thought that the alum plant would only be used for a comparatively short period of time. The plant consists of an acid storage tank, a dilute acid tank, bauxite weighing hopper, Stedman mixer, and concrete crystallizing tray. No crusher is provided, the filter alum being broken up into suitable sized lumps by hand sledges.

Temperature of Acid Controls Character of Alum

The manufacture of Hoover Process filter alum is simple, but like every simple thing there are several necessary conditions that need to be carried out to ensure the product desired. By varying the temperature of the dilute acid, the character of the alum can be modified. During the winter months a porous alum is desired because of its greater solubility, and this product can be obtained by mixing the bauxite with a low temperature acid. During the balance of the year a filter alum of a denser texture is secured by using a higher temperature acid. The temperature of the crystallizing tray floor is also a factor to be considered, and it is necessary to use a higher temperature acid for Monday's batch because of the lower temperature of the tray floor after the Sunday rest. The temperature of the acid is controlled by agitating with compressed air and with a cooling coil placed at the bottom of the lead-lined dilute acid tank. By using the air and cooling coil for different periods of time, a dilute acid of the desired temperature can be obtained.

In securing a uniform product from day to day, care must be taken to have the acid uniform, the temperature variations slight and the weight of the bauxite charge correct. The analytical work necessary to control the operation of the alum manufacturing plant consists of the analysis of the bauxite, acid and finished product, and the taking of the specific gravity and temperature of the dilute acid before a batch of filter alum is made.

Alum Manufacture

A batch of alum (approximately 7600 lbs.) is made in five mixes using about one-fifth of the material for each mix; the time consumed in mixing a batch of alum is about three-quarters of an hour. Greater speed in mixing could have been obtained if a mixing pan and two agitators had been installed; also a better mixture of the bauxite and acid could have been obtained. The batch of alum is usually made early in the afternoon and by the next morning the alum cake is ready to be removed from the crystallizing tray. Before the mixture of bauxite and acid is dumped into the tray, the fine alum dust remaining in the tray is swept up into a ridge extending directly across the tray and to a height of about 2½ in. When the alum cake is to be removed from the tray, work is started at the alum dust ridge as this point offers an easy place to pry the slabs of alum from the tray floor. The alum cake is removed from the floor with bars and picks and is broken up with hand sledges. The whole process, including carting to the storage floor above, consuming about six hours.

Alum Plant Saved $49,000 in Two Years

Records of the alum making plant for the past two fiscal years ending May 1st last have been taken off, as during this period the cost of bauxite and acid have been rather constant and it was thought that data covering this period would be fairly representative of present conditions. The cost of production for this two years period is as follows:—

Bauxite and acid	$45,961.00
(Including freight and cartage)	
Wages	4,220.00
Maintenance	1,490.00
Interest and Depreciation—20 per cent.	2,400.00
Total	$54,071.00

During this two-year period, 1888 tons of filter alum have been produced, making the cost work out at $28.64 per ton. The market price of commercial filter alum (including freight and duty) during this period has been $55.00 f.o.b. Montreal and based on this figure the alum-making plant has shown a saving of slightly more than $49,000 for the two year period. During this time bauxite has cost approximately $24.00 per ton and 66° Baume sulphuric acid, $26.00 per ton. At places where these two materials can be purchased at a lower figure, the cost per ton for filter alum will also be correspondingly lower, because from the cost data presented it will be noted that the cost of bauxite and acid makes up 85 per cent. of the total cost.

In the manufacturing of filter alum at the point of consumption, freight, bagging and cartage is saved on the water which makes up about 20 per cent. of the finished product. Experience over a considerable period has shown that the weight of the filter alum produced is practically the same as the combined weight of the materials that go to make up the product.

Greater Depreciation of Fittings

At the company's water purification plant the alum solution is pumped to the orifice box and from this point flows by gravity to the point of discharge. Since Hoover Process filter alum has been used, greater depreciation of the solution pumps, valves, and fittings has taken place, due to the nature of the insoluble matter contained in the alum solution. This depreciation, however, has not been excessive and has not run into an appreciable figure.

The manufacture of Hoover Process filter alum has proved successful for the Montreal Water & Power Company because of the saving effected. A further advantage is also gained as sulphuric acid is produced within a short radius of Montreal and is easily obtainable, leaving only the bauxite to be secured from a distance, and when secured, each ton of bauxite in storage represents about three tons of the finished product.

Mr. Meadows' paper drew out a number of questions in regard to the percentage of alumina found in the Hoover process alum. It was stated that between 17 and 18 per cent. of the finished product is alumina. Mr. Gore, of Toronto, requesting information regarding the purity of Hoover alum, was told that 7 per cent. or so consisted of insoluble impurities. As far as the coagulation produced by Hoover and commercial alum was concerned, not much difference was noticeable.

Unwaranted Extravagance in Use of Water

Water Waste Prevention Campaign Might Accomplish More Towards Providing an Ample Supply Than a Large Expenditure on Enlarging Works—Too Little Economy in the Past

By Geo. A. Johnson, Consulting Engineer, New York

THIS general discussion on the legitimate uses of water naturally means that somebody is, or ought to be, about to say something concerning the wasteful habits of the inhabitants of the northern part of the western hemisphere. This need not be restricted to the mere waste of water; it can properly go further and include the waste which is evident in many localities in practically every department of municipal water works. Water waste is but a part of the story; the codicil to the will which bequeaths unwarranted extravagance.

Deputy Water Commissioner Liebeneau of New York recently said that one-third of the water supplied to New York is being needlessly wasted. Recalling the remarks of Commissioner Galvin to the mayor, in his letter of resignation from the Board of Water Supply, that provision must be made at once for more water for Greater New York, even in the face of the fact that the new Catskill project is practically the newest baby in the public works house of New York, Mr. Liebenau's statement relative to water waste must necessarily lead a man with capacity for deductive thought to conclude that something is wrong with our methods. We go to great expense to increase the volume of our supply when for practically an insignificant sum we can conduct a water waste prevention campaign, as indeed New York is now doing, and perhaps so stave off the fateful day of water works extension until prices descend within reach of us, or the economic situation in the country is readjusted on a plane where supply and demand will balance.

More Attention to Economy

Although the water works of the country in their several mechanical equipments show numerous straps and patches, conspicuous complaints over the lack of essential service, or prodigious conflagrations because of inadequate fire protection, are lacking. Is it possible that in the downily prosperous days of the past we replaced at high cost where we could just as well have repaired at small expense? Have we laid new mains, built storage reservoirs and installed new pumping units in order to obtain more water when we could have accomplished the same end effectively by searching out and stopping unnecessary waste of water, installing meters, cleaning mains to restore their original capacity, thereby cutting down friction losses and saving the coal pile and generally attending strictly to our job?

There seems to be real occasion for serious debate respecting whether the war period, and the manner in which we lived through it, has not furnished a lesson which most of us refuse to understand, namely, that it really is possible to get satisfactory service on a restricted program of water works extension, machinery replacement and the like, if we pay more attention to economy in all lines and exploit the more economical potentialities at hand to a far greater extent than we did before the war. It seems to be deplorably true that quite on the contrary, as an average proposition, we have followed the line of least resistance when the water consumption threatened to exceed the supply.

Actual Needs

It does not require 100 gallons of water daily to keep clean the epidermis and surroundings of the average American, carry away his sewage, cook his food and provide him with drink, or to furnish his share towards the water needs of the industries in his community. The New York water authorities seem to think that 80 gallons per capita is enough water for all domestic, municipal and industrial needs of that city, and the speaker feels likewise. There seems to be no good reason why one city should hang up an actual water consumption record of 70 or 80 gallons per capita daily, and another of approximately the same size and industrial activity show a water consumption of three times that amount. And yet such occurrences are a matter of not uncommon record.

Reducing Wastes in Army Camps

The speaker may perhaps be pardoned for referring again to the war period, for his experience in the management of the utilities in the army cantonments points a moral in the problem of water consumption. It is true that the use of water in these establishments was purely of a domestic character, yet the results were none the less striking.

The experience gained at these big military establishments showed positively what can be done with water supply systems hastily put together of any material most readily obtainable; with pipes of all conceivable sizes, practically regardless of what demands were to be placed upon them aside from the basic requirement that they pass water and enough of it; with motors often unsuited to pumping units and many other incongruities, all or almost all but the natural sequence of a program of unparalelled and urgently necessary construction. Coupled with structural idiosyncracies was the intense use to which these plants and systems were put during the war. Called upon to render service for which they were not built, overloaded much of the time, subjected to sudden and grave demand fluctuations, they were held together, maintained economically and made to function efficiently.

In the sixteen National Army cantonments, each housing an average of 38,000 troops and from 4,000 to 9,000 animals, with their sewerage systems, shower baths, flush tanks and all the modern conveniences for wasting water; with a soldiery, many of whom had never before seen running water except in brooks, manipulating compression cocks, the water consumption during the summer of 1918 (May to October, inclusive) was held to an average of 55.8 gallons per capita daily. Everybody had enough water, but waste was cut to a minimum by ceaseless and detailed inspection and watchfulness.

Extravagant Replacements

It seems clear that in the passed days of plenty we have lent ourselves too readily to the fascinating pasttime of installing new machinery where the old would do; to extend where the existing equipment, suitably improved, would answer for a period of years. In other words, is it not probable that the demand for building materials and equipment has been and still is far in excess of the real requirements, and that instead of encouraging economy we have practiced unnecessary extravagance where a little ingenuity and good management would have produced economically just as good results? It would seem so.

As an integral part of the program of conservation, water waste prevention is of cardinal importance. What can be done by intelligent and persistent effort in this direction is not so well understood as it should be, considering how long the salutary effects of such endeavors have been known to those who study the question. Nearly two thousand years ago Water Commissioner Frontinus of Rome took up the question of water waste in that city, and as a result, was able to report, according to a translation of his writings by Clemens Herschel, "Whatever had been unlawfully drawn upon by the water men, or had been wasted as the result of official negligence, has been recovered. This is practically equivalent to the finding of new sources of supply. And in fact the supply was almost doubled."

Hazen, in his book "Meter Rates for Water Works," has discussed water wastage in a very attractive way. He says in part: "When a water-works system is first installed, all the plumbing fixtures in houses are new and they are in general reasonably tight; people will ordinarily draw only the amounts of water that they need, and waste is comparatively small in amount. As time goes on, rust, corrosion, the hardening of rubber valves, and other changes result in leakage from plumbing fixtures. Small leaks running constantly make little impression on people who do not realize their significance. Yet a leaky water closet may weste without attracting attention as much water as would supply twenty families.

"As time goes on people become accustomed to the waste of water in their houses and indifferent to it; and it is the experience of American cities where the meter system has not been used that the consumption always increases more rapidly than the population. It may be a long time before the output becomes double the legitimate use; but after that point is reached the rate goes on with greater acceleration until three-quarters of all the water that is furnished is wasted.

"The only limit to the increase is that a time comes when the new works required to supply the ever-increasing waste become so large and cost so much to build, that the burden cannot be further borne, and a better method is adopted."

What is needed now is action, and not discussion. If as water works men we are to do our appropriate part in untangling the financial snarl which involves the economic life of the world today, we can do no better than to bend our best efforts to cut down the illegitimate uses of water and reduce so far as is feasible expensive replacements and extensions. The former will long defer the necessity of developing new sources of supply, and the latter will develop to its utmost our engineering ingenuity. This will not be following the line of least resistance, but it assuredly will lead to material economy without risk of impairment of satisfactory service.

The Increase in the Cost of Housing

A most careful analysis of the cost of housing has been prepared recently by some of the architects, engineers and builders who served with the United States Housing Corporation and who have had national experience in their lines of work. Under this analysis it is found that the cost of housing on June, 1919, had increased 70 per cent. over the cost of housing in 1913. The analysis further shows that the increased cost of materials and the increased cost of labor were each equal to 70 per cent. During the past year there has been a somewhat further increase in prices. This percentage was worked out very carefully from specific cases and there are wide variations from this figure in particular localities.

Solution of the Housing Shortage

The solution of the housing shortage, under the high prices of today, according to L. K. Sherman, president of the United States Housing Commission, will come from collective building by such housing corporations combined with the constructive genius who can, in his designs, assemble such materials as will produce a good house with the least expenditure for field labor.

The Rockland Housing Company, Ltd., Montreal, has been formed with a capital of $100,000 to assist in the construction of dwelling houses under the Workmen's Dwellings' Act.

Water Works Operating Under Heavy Burdens

Analysis of Operating Data of United States Plants Indicates that Financial Outlook is Not Encouraging—Earnings Have Not Been Adequate to Maintain the Properties and Pay Fair Return

By Leonard Metcalf, Consulting Engineer, Boston, Mass.

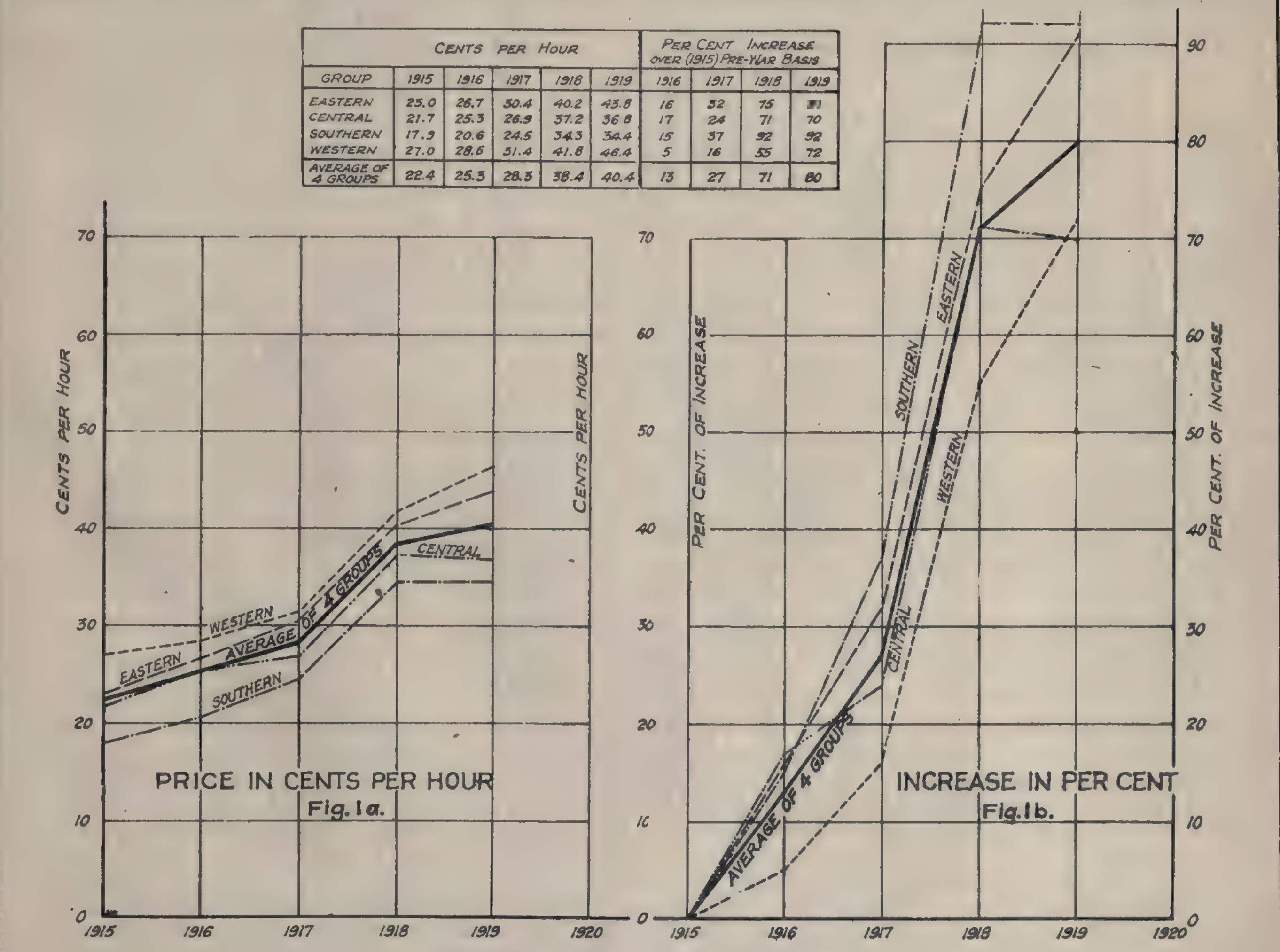
THROUGH the courtesy of the waterworks managers it has been made possible to extend to January 1, 1920, the data submitted in 1918 and 1919 to the American Water Works Association, upon the trend of prices in the water works construction and operating fields, based upon the actual experiences of about 50 water works in various parts of the United States, having a gross annual revenue of about $34,000,000 and serving an aggregate population of upwards of nine million. In the light of the burdensome increase in cost of living, even since the termination of the war, and the many evidences of profiteering in different fields and commodities, it is gratifying to be able to say that, as a whole, and probably without substantial exceptions, the water works of this country have met their obligations to the public in a conscientious, effective and adequate manner and in spite of dangerous reduction in profit in almost all cases, and actual elimination in many.

In Table 1 is shown a summary of data upon increase in cost of unskilled labor and of materials used in the construction and operation of water works.

Unskilled labor costs continued their advance during the year 1919 and are yet higher to-day. The percentage of increase in cost per hour over 1915 prices averaged about 80 per cent.—approximately 70 per cent. in the western and central groups and 90 per cent. in the eastern and southern. The average increase for the year 1919 over 1918 is about one-eighth. These results are also shown diagrammatically in Fig. 1.

While the efficiency of labor is probably slightly better than during the war period, it is still far below pre-war standards. It is conservative to say that taking productivity into consideration, as well as the price paid per hour, the cost of unskilled labor is more than double its pre-war cost.

Cast iron pipe prices are to-day practically three



	CENTS PER HOUR					PER CENT INCREASE OVER (1915) PRE-WAR BASIS			
GROUP	1915	1916	1917	1918	1919	1916	1917	1918	1919
EASTERN	25.0	26.7	30.4	40.2	43.8	16	32	75	[illegible]
CENTRAL	21.7	25.3	26.9	37.2	36 8	17	24	71	70
SOUTHERN	17.9	20.6	24.5	34.3	34.4	15	37	92	92
WESTERN	27.0	28.6	31.4	41.8	46.4	5	16	55	72
AVERAGE OF 4 GROUPS	22.4	25.3	28.3	38.4	40.4	13	27	71	80

PRICE IN CENTS PER HOUR
Fig. 1a.

INCREASE IN PER CENT
Fig. 1b.

Fig. 1—Increase in cost of unskilled labor

Table 1.—Summary of Data upon Increase in Cost of Unskilled Labor and Materials to Water Works in the United States, from Pre-war Basis (characterized by 1915 costs) up to 1920.

Item	Number of Records on Different Years	Prices per Unit					Per Cent Increase over 1915 (Prewar Basis)			
		1915	1916	1917	1918	1919	1916	1917	1918	1919
1. Unskilled Labor in cts. per hour										
(a) Eastern Group	15-18	23.0c	26.7c	30.4c	40.2c	43.8c	16	32	75	91
(b) Central Group	10-12	21.7c	25.3c	26.9c	37.2c	36.8c	17	24	71	70
(c) Southern Group	9-12	17.9c	20.6c	24.5c	34.3c	34.4c	15	37	92	92
(d) Western Group	7- 8	27.0c	28.5c	31.4c	41.8c	46.4c	5	16	55	72
(e) Average of Groups		22.4c	25.3c	28.3c	38.4c	40.4c	13	27	71	80
2. Cast Iron Pipe per 2000 pounds approx.	17-21	$24.23	$30.70	$51.60	$67.74	$69.20*	27	113	179	184
3. 6" Valves	11-38	11.18	12.64	19.13	19.13	20.73	13	71	71	85
4. 12" Valves	3-38	34.78	41.53	65.22	65.02	59.66	19	88	87	72
5. 2-way Hydrants	6-38	26.69	32.04	43.13	51.80	47.16	20	62	94	77
6. Coal per 2000 lb.										
(a) Eastern... Group	13-15	$ 2.98	$ 3.80	$ 5.96	$ 6.00	$ 5.41	27	100	101	82
(b) Central Group...	11-12	2.41	2.77	3.75	4.53	4.55	15	56	88	89
(c) Southern Group	12- 9	1.92	2.01	3.03	3.89	3.78	5	58	102	97
(d) Western Group**	5- 4	3.97	4.37	6.31	7.92	4.70	10	59	99	18**
(e) Average of Groups		$ 2.82	$ 3.24	$ 4.77	$ 5.57	$ 4.61	15	69	97	63
7. Fuel Oil in cts. per gallon South	1	1.80c	1.80c	2.00c	4.28c		0	11	138	
ditto West	1- 4	1.38c	1.50c	2.57c	4.05c	4.09c	9	86	193	197
8. Alum, cts. per. lb.										
(a) Eastern Group		1.12c	1.72c	1.48c	1.45c	1.66c	54	33	29	48
(b) Central Group		0.91	0.91	1.25	1.50	1.40	0	37	65	54
(c) Southern Group		1.08	1.38	1.48	1.78	1.56	28	37	65	44
(d) Western Group		1.14	1.21	1.51	1.53	1.79	6	32	34	57
(e) Average of Groups		1.06c	1.30c	1.43c	1.56c	1.60c	22	35	47	51
(f) Average N.Y. Price		2.08c	4.63c	3.57c						

*Range $50.60 to $83.50 per ton.

**Small number makes record of doubtful value.

Table 2.—Labor Prices Paid by Water Works in the Vicinity of Boston, March 23, 1920

Place	Unskilled Labor per day Nominal Rates	Unskilled Labor per hour Actual Rates	Pipe Layers and Caulkers, per day	Pipe Layers and Caulkers per Hour	Hours per Week	Holidays	Vacation, 2 Weeks Paid	Increase in Wages anticipated	
1. Boston	4.00	0.586	4.25-5.00	0.621-0.732	44	Paid	Yes	No	4/1/20
2. Somerville	3.75	0.549	3.85	0.564	44	Paid	Yes	—	
3. Newton	4.00	0.526	4.24-4.32	0.557-0.568	44 48	Not paid	No	?	
4. Lexington	3.50	0.437	3.75	0.469	48	Not paid	No	Yes	
5. Waltham	4.16	0.589	4.48	0.635	44	Not paid	Yes	No	2/1/20
6. Everett	4.25	0.621	4.75	0.621	44	Paid	Yes	Yes	
7. Chelsea	4.00	0.586	4.25	0.621	44	Paid	Yes	No	
8. Quincy	4.00	0.586	4.50	0.659	44	Paid	Yes	No	
9. Medford	4.25	0.621	5.00	0.732	44	Some	Yes	—	3/1/20
10. Melrose	4.00	0.586	4.25-4.50	0.621	44	Paid	Yes	Yes	
11. Revere									
12. Watertown	4.00	0.586	4.25	0.621	44	Paid	Yes	Yes	Ask $5
13. Arlington	4.00	0.586	4.25-4.50	0.621	44	Paid	Yes	Yes	
14. Milton	4.00	0.534	4.50	0.60	48	Paid	Yes	No	
15. Winthrop	4.00	0.534	4.25	0.567	48	Paid	Yes	No	
16. Cambridge	4.00	0.586	4.25	0.621	44	Paid	Yes	—	3/1/20
17. Brookline	4.25	0.584	4.42	0.608	44–48	Paid	Yes	No	4/1/20
18. Marlboro	4.00	0.500	4.25	0.531	48	Not paid	No	Yes	
19. Hudson	4.00	0.518	4.50	0.582	48	Not paid	Yes	No	
20. Fitchburg	4.40	0.569	4.96	0.642	48	Not paid	Yes	—	3/15/20
21. Beverly	4.50	0.659	4.75	0.694	44	Paid	Yes	—	3/18/20
March 23, 1920	$4.05		$4.38		13 of 44 &	14 Paid 6 Not	17 Yes 3 No		
Average	50.6c	56.7c	54.7c	61c	8 of 48				
April, 1919	$3.46		$3.82		15 of 44 &	13 Paid 8 Not	16 Yes 5 No		
Comparative Average	43.2c	46.1c	47.7c	51c	7 of 48				

times normal pre-war prices; the cost of valves and hydrants slightly less than double.

Coal prices have receded somewhat, more nearly approaching the conditions of 1917 than 1918.

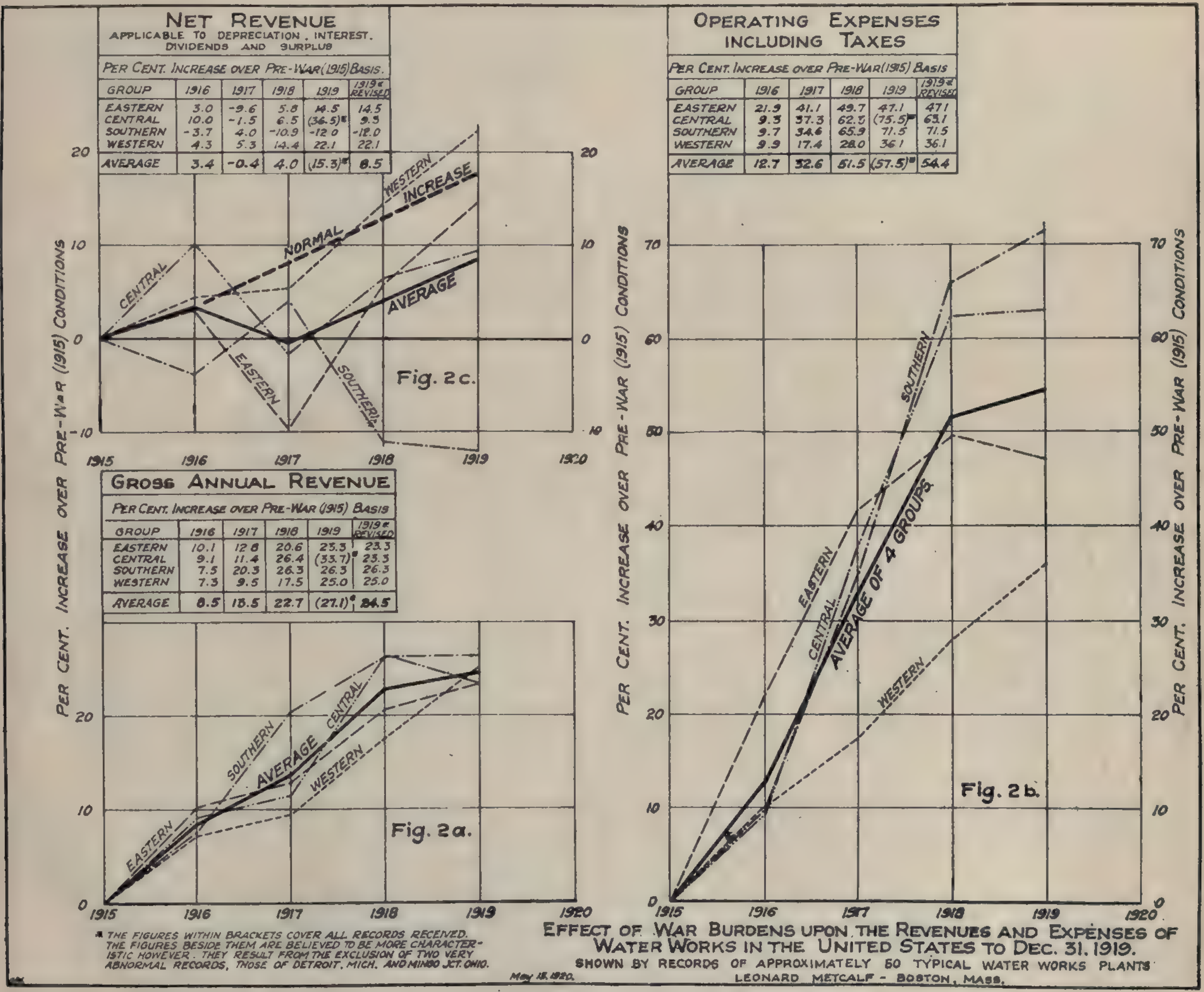
In Table 2 are given comparative figures showing unskilled labor wages paid by water works in the vicinity of Boston, as of the end of March, 1920. Comparing them with the records of a year earlier the nominal increase in rate per hour has been from 43.2c to 50.6c; the actual increase, including allowance for holidays and vacation leave, from 46.1c to 56.7c per hour or 21 per cent. Fourteen out of twenty departments grant holiday leave under full pay, and seventeen out of twenty, two weeks vacation annually under pay.

Revenue and Expenses

In Fig. 2 are shown the gross annual revenue, operating expenses including taxes, and the net annual revenue applicable to depreciation, interest, dividends and surplus, of forty-six works arranged in four groups covering the eastern, central, southern and western sections of the country. The percent increase over the pre-war conditions, exemplified by those of the year 1915, are given, together with the average rate of increase applicable to the entire list.

Attention is called pointedly to the fact that these figures are shown in two ways, with and without the inclusion of the records of the cities of Detroit and Mingo Junction. The conditions there prevailing have been so very abnormal, it is believed, as to require the elimination of these records from consideration in deriving average figures.

From this record it appears that the gross annual revenue has increased in the years 1916 to 1919, inclusive, over pre-war conditions, progressively, by 8.5 per cent., 13.5 per cent., 22.7 per cent. and 24.5 per cent. These amounts are all substantially below a normal rate of increase for such works.



Net Revenue
Applicable to Depreciation, Interest, Dividends and Surplus

Per Cent. Increase over Pre-War (1915) Basis.

Group	1916	1917	1918	1919	1919* Revised
Eastern	3.0	-9.6	5.8	14.5	14.5
Central	10.0	-1.5	6.5	(36.5)*	9.5
Southern	-3.7	4.0	-10.9	-12.0	-12.0
Western	4.3	5.3	14.4	22.1	22.1
Average	3.4	-0.4	4.0	(15.3)*	8.5

Gross Annual Revenue

Per Cent. Increase over Pre-War (1915) Basis

Group	1916	1917	1918	1919	1919* Revised
Eastern	10.1	12.8	20.6	23.3	23.3
Central	9.1	11.4	26.4	(33.7)*	23.3
Southern	7.5	20.3	26.3	26.3	26.3
Western	7.3	9.5	17.5	25.0	25.0
Average	8.5	13.5	22.7	(27.1)*	24.5

Operating Expenses including Taxes

Per Cent. Increase over Pre-War (1915) Basis

Group	1916	1917	1918	1919	1919* Revised
Eastern	21.9	41.1	49.7	47.1	47.1
Central	9.3	37.3	62.3	(75.5)*	63.1
Southern	9.7	34.6	65.9	71.5	71.5
Western	9.9	17.4	28.0	36.1	36.1
Average	12.7	32.6	51.5	(57.5)*	54.4

* The figures within brackets cover all records received. The figures beside them are believed to be more characteristic however. They result from the exclusion of two very abnormal records, those of Detroit, Mich. and Mingo Jct. Ohio.

Effect of War Burdens upon the Revenues and Expenses of Water Works in the United States to Dec. 31, 1919.
Shown by records of approximately 50 typical water works plants
Leonard Metcalf - Boston, Mass.

Fig. 2—Fluctuations in operating expenses and revenues

The operating expenses including taxes have increased progressively over the pre-war basis by approximately ⅛, 1/3, ½ and slightly over ½.

The net revenue, without deduction for and therefore applicable to depreciation, interest, dividends and surplus, has increased over the pre-war (1915) basis by 3.4 per cent., -0.4 per cent., 4 per cent. and 8.5 per cent. This increase is less than half of what would be expected for such works in normal times. These figures indicate that in spite of the advances in rates, which have been granted in many places, the net revenue of the works is not adequate to command capital for their betterment over a long period of time. They indicate further, as will be seen from the diagram, that of the net burden resulting from war conditions about half has been borne by the works; the other half by the public which they serve.

Comparison Between Privately and Municipally Owned Works

A segregation of the records submitted, as between municipally and privately owned works, indicate that the increase in gross revenue for both of these has been approximately the same; that the increase in expenses has been more than twice as great for the privately owned group as for the municipally owned; and that the net revenue of the privately owned group has practically stood still while the municipally owned group has been increased approximately 40 per cent. This comparison cannot be carried too far, however, as the list of municipally owned works is not sufficiently large to be thoroughly characteristic. Moreover, in the case of the municipally owned works the records of which are included, a much greater proportion have gravity supplies than in the case of the privately owned group. This has served to minimize the increase in expenses which would otherwise have been felt. It may be that the decrease in available labor during the war period had a more material effect upon the municipal works than upon the private works and resulted in economies which would not have been possible in these public works under normal conditions. More important yet, it is to be observed that, in the case of the municipal works, substantially no taxes are paid, whereas in the privately owned group the taxes generally amount to about one-eighth of the entire gross revenue, and these taxes have, of course, been burdensomely increased since the war burdens began to make themselves felt. This influence is the most important one of those responsible for the comparative results referred to. As previously stated, however, limited weight only can be given to these comparative results of operation by municipally and privately owned water works.

Analysis of taxes paid by privately owned water works shows interesting results. Excluding the returns from water works located in the State of Pennsylvania, because the basis of taxation is quite different there and incomparable with that prevailing in other states, it appears with respect to the privately owned water works that, under average conditions,—

1. One-eighth of their gross income is paid out in taxes;
2. The tax payments are equivalent to nearly 30 per cent. of the net income applicable to depreciation, interest, dividends and surplus;
3. The increase in taxes paid in the year 1919, over those paid in 1915, was 68 per cent., or slightly over two-thirds;
4. The increase in the taxes paid in 1919 over those paid in 1915, constituted 27 per cent., or slightly over one-fourth of the increase in the cost of operation (including taxes) of these works.

Summit of High Prices Reached

It is generally conceded that the summit of the high prices has been reached, where it has not been passed, and that, as to materials at least, and probably in lesser degree as to labor also, some recession in price is to be looked for. There is still, however, so marked a shortage of materials and labor, comparable with the demand, that construction costs are certain to remain high during the year 1920.

The financial outlook for existing water works is not encouraging. It is evident that the earnings during the war period have not been adequate to maintain the properties and pay a fair return upon their value. Such a condition cannot long continue without serious future embarrassment. The position that may be taken by the public service commissions or their regulatory authorities, will be reflected later in the character of the service rendered. If fair advance in rates be granted, first class service can be maintained. If this advance be retarded or be not adequate, a declining service must result. The increase in rates in the face of the present high cost of living will be very distasteful to the public and in some cases induce active opposition. Therefore it is important that in making application for relief, the evidence should be clearly presented by the water works authorities, that the facts may speak for themselves and the difficulties of the commissions be minimized.

Co-operative Research in Problems of Water Purification

By Abel Wolman

SCIENTIFIC investigation in the field of water purification has progressed for a number of decades, but it may be stated with safety that during this entire period the study of problems has been, for the most, part, intermittent, sporadic and disconnected. The development of data has been the result of local efforts in the laboratories of individual colleges, states, municipalities, or private corporations. What co-operation has existed has been localized and not national.

The history of individualistic research effort in water purification, as in a number of allied fields, has been that of "a kind of guerilla warfare upon the unknown." While such warfare may result in temporary victories over isolated problems, in intermittent eliminations of difficulties in one place, it never produces a complete surrender of natural opposing forces to the control of man. The solution of the problem of chlorinating the St. Lawrence River water, for instance, while of immediate value, is of but little aid in solving the general problem of chlorination of waters, unless the methods, conclusions and conditions of the first problem are subjected to the composite scrutiny and checking of co-operative workers elsewhere. It is true, no doubt, that under present conditions the individual scientists find it difficult practically to choose arbitrarily that line of study which seems to promise more remote but more valuable results, while the material at hand has the attractiveness of immediate practical application, if only to the restricted field with which he is familiar. Every problem will be solved, however, more satisfactorily and more permanently if the attack is made from many viewpoints, under different conditions, and by various investigators. The personal stressing of unimportant aspects, the individual errors, the apparent but unreal significance of local characteristics, and the restricted mental conception of a problem, are all likely to be eliminated or reduced by co-operative research, with the ultimate production of a sounder and a more accurate series of scientific observations and conclusions.

Canadian Clay Co., Ltd., with head office at Toronto, capital $500,000, to manufacture and deal in brick, tile, sewer and drain pipe, etc.

Cost-Plus Contracts for the Construction of Water Works Plants

Their Adoption is an Attempt to Cope with Uncertain Conditions of the Present Time and They Have Advantages when Applied with Proper Safeguards—Contracts Should Place Burden of Uncertainty on Owner—Author Urges Limitation of Water Works Construction.

By George W. Fuller, Consulting Engineer, New York

PRIOR to the Great War the "cost-plus" form of payment on contracts in the water works field was limited to a relatively few large projects built as a whole under this type of contract for private corporations and to numerous small unexpected features of enterprises executed under municipal contracts where "extra work" clauses were attached to either lump-sum (bulk) or unit-price contracts. During the war a large amount of emergency government work which had to be performed in the shortest possible time, gave great impetus to the "cost-plus" form of contract, or what the British call "prime cost-plus profit" type of contract.

The unstable condition of the market for labor and materials now found in many places causes this form of handling construction work to come up repeatedly for discussion. Such discussion results from the necessity for finding expedients to meet present emergencies which, while not comparable with those of the war period, are nevertheless present during this reconstruction period to an extent which, perhaps is not generally recognized.

At this time when contractors are sorely puzzled to know how to bid or tender on construction materials on which quotations are made by dealers only on the basis of changes in price contingent on the actual date of future deliveries, and when labor is uncertain in quantity and of reduced and somewhat uncertain efficiency as to output of work per hour, it is obviously necessary to look conditions squarely in the face. Add to this the difficulties in transportation of construction materials and the loss incident to the contractor having a substantial payroll for labor when materials to work with are lacking, and it is readily seen that this is a time for considering fundamental principles in handling construction work to an extent that would not be of interest under normal conditions.

Defer Water Works Construction

The writer believes that water works construction which can reasonably be deferred should not be contracted for at present. In the case of many water works projects the existing work can, with propriety, be patched and overhauled in a manner similar to that adopted by the individual who, under present stress, makes use of old and patched clothes. There are some water works betterments which cannot be postponed owing to the fact that this expedient has been resorted to for so long that further postponing means positive disaster along various lines associated with a water famine.

Much needed work is now possible of accomplishment due to the inability of labor agencies to supply men, of manufacturers to supply material, and of transportation facilities to deliver goods. Competition between owners will only increase the already serious aspect of obtaining material for construction work which it is important to have done in the near future.

Some water works construction must go forward. With conditions as they are at present, the contractor, if he bids on a lump-sum or unit-price basis, is bound to name a price which, in his opinion, will protect him from loss and, if possible, assure a reasonable return on his capital investment and for the work of himself and his organization. Under these circumstances it is important to discuss briefly the cost-plus form of contract with a view to seeing if the burden of uncertainty in some respects cannot be shifted from the contractor to the owner to the advantage of all concerned. In fact, if construction work is to go forward there are some projects where such steps seem imperative.

Legality of Cost-Plus Contract

Before pointing out briefly the advantages and disadvantages of the cost-plus form of contract, it is well to recall that there is serious doubt as to the legal right of municipalities, in some localities at least, to enter into such contracts. State and provincial laws and municipal charters usually call for the letting of contracts for public works by open, competitive bidding for all work in excess of certain specified amounts. Also such laws provide, almost without exception, that contracts shall not be made in sums in excess of appropriations duly authorized and, in some cases, above the estimates of the engineer of the governing body.

As regards the first restriction the intent is obviously to take advantage of competition in making sure of proper market prices. The second restriction is a check on total estimated costs by actual bids for the work. In the absence of preliminary bidding, work might be started when appropriations are insufficient for completion, or opportunities might be lost for reducing costs by subsequent lettings through correction of misunderstandings as to construction procedures. Stabilization through such restrictions should not be abandoned unless there is a great emergency.

Cost-Plus Contracts Often Desirable, Sometimes Necessary

There have been and always will be certain construction problems in which some means of payment in the form of actual cost plus a percentage or lump sum is legitimate and desirable, if not necessary. This is true even with lump-sum contracts in which certain features may be indefinite or subject to changes regarding the character of the work. Cost-plus provisions for extra work, or supplementary contracts based on such arrangements or estimates, are also pertinent where sufficient investigation previous to a letting is undesirable or too expensive in time or money for the advantage gained, such as extensive street openings to locate existing structures, and also in cases where the owner desires to retain complete control of the work regardless of the cost.

It is claimed that under the cost-plus method a contractor has little incentive to keep down the cost of the work. This is frequently true of the cost-plus percentage, but need not be true of the cost-plus-lump-sum type. In any case, it must be remembered that a contractor who will deliberately be inefficient on a cost-plus project is equally sure to attempt improper or inadequate construction on lump-sum or unit-price agreements.

There have been a great many variations of the cost-plus contract applied to construction work, but the more important are:

1. Actual proved cost with labor and material furnished without restriction by the contractor, plus a fixed percentage or lump sum to represent profit, supervision, financing, use of tools and plant, or any or all of these.

2. Actual proved cost of labor furnished by the contractor and with materials furnished by the owner, with a fixed percentage or lump sum, as above.

3. Actual proved total cost for specified work plus a percentage for specified or unexpected extra or unforseen work in connection with lump-sum or unit-price contracts.

4. Actual proved total cost to the contractor plus a sliding scale fee and upset maximum fee.

5. Actual proved total cost to the contractor plus a sliding scale fee and upset maximum fee.

5. Actual proved total cost to the contractor plus a fixed plant charge and fixed construction fee.

Advantages Claimed for Cost-Plus Contracts

1. The work may be started at any time and is not dependent on the prior completion of the plans.

2. The owner may radically increase or decrease the quantities during construction, with lump-sum fees subject to review.

3. The owner may change the kind of construction during the progress of the work.

4. The contractor will not try to skimp the job as is often done after finding himself losing under lump-sum or unit-price contracts.

5. There is less need of having accurate preliminary estimates. In unit-price contracts the preliminary estimate is often so approximate as to cause the contractor to gamble on some of the items, with resulting disappointment to the owner in the ultimate cost of the work. Such procedures sometimes cause an unfair result either to the owner or contractor or both.

6. Unit-price or lump-sum bids require a set of specification definitions which are not always clear and are sometimes deficient and sometimes overlapping. Such ambiguities may lead to arguments and variations in cost which result in claims and suits for extra work.

7. Cost-plus contracts may save the owner the money which the contractor usually adds to his lump-sum or unit-price bid to cover the complete but actually infrequent enforcement of material tests which cause him delay and expense, or necessitate the carrying of a large stock, entailing interest charges, storage space, rehandling, etc.

8. Cost-plus contracts do away with the substantial sums usually added in lump-sum or unit-price contracts to cover the following uncertainties: (a) weather, (b) foundations, (c) changes and shortages in labor market, (d) changes and shortages in material market, (e) delayed deliveries of materials.

9. For cost-plus work it is the contract and not the specifications which is the crux of the matter from both the owner's and contractor's viewpoint. The writing of the contract is more simple than the writing of the specifications.

10. Cost-plus contracts tend to promote co-operation between the owner and the contractor.

Disadvantages Claimed for Cost-Plus Contracts

1. There is no way of determining the approximate cost in advance and this upsets budgets where definite appropriations have been made or are required.

2. Competition, the key to efficiency, is killed.

3. Greater opportunity is offered for favoritism on the part of the owner's representative.

4. Where the same contractor has several jobs, the lump-sum and unit-price contracts will get the good workmen and the cost-plus contract will get the drones and misfits.

5. A large general contractor often takes a job on the cost-plus basis and sublets it to several smaller contractors on a lump-sum or unit-price basis. In making the sub-contractors complete the work on the latter basis, the general contractor often treats them unfairly, while he, himself, may be receiving a substantial profit for doing little or nothing.

6. Should work be started before plans are completed, many errors may have to be straightened out in cases where competent engineers would avoid them if given an opporountity to get out a complete set of plans and accurate estimates of quantities.

7. Engineers are tempted to be less thorough in their work when they know that there will be no come-back at them on account of extras resulting from their failure to have plans and specifications complete when needed. With cost-plus contracts it may simply be a matter of correcting an error or supplying a deficiency when discovered, but the cost is there just the same, although it may not appear as an "extra."

8. Engineers or other representatives of the owner must do an immense amount of accounting and clerical work in checking payrolls, material bills, etc., and expend much time and energy in expediting the delivery of materials.

9. A premium may be put on extravagances and waste by giving unscrupulous contractors and engineers a chance to take advantage of the owner.

10. The owner may procrastinate in securing, if not refuse to secure, promptly, adequate tools and equipment as to type and number.

11. A combination of the above disadvantages, although no one by itself may be sufficiently pronounced to permit the owner successfully to obtain relief, may cause grief for the owner, unless protected by a maximum fee to the contractor, and by the assured adequacy of the latter's organization and equipment.

Pre-War Status of Cost-Plus-Percentage Contracts

Much large construction work was and is done by railroads and other corporations in this way, but this is done usually because these corporations, unlike municipalities, are legally able to select competent contractors with efficient organizations and equipment to work under the immediate direction of a skilled and alert staff of the owner who, for the most part, purchases supplies and material direct. The Grand Central Terminal in New York is a case in point. Much of the work was first awarded to a contractor on a unit price contract, but it was completed under a cost-plus agreement.

There can be no question that some work can be as economically and efficiently done under the cost-plus basis as in other ways. But in the waterworks field such work appears to form the exception rather than the rule under peace time conditions.

Army Contracts for Construction Work

One of the best examples of cost-plus percentage agreements is found in the U. S. army construction work during 1917-18. Here the contract was on what is known as the "cost-plus-a-sliding-scale-fee," with a maximum upset fee. Overhead expenses and interest costs reduced the actual profit to most cantonment contractors to less than one and one-half per cent. In this case the specified cost of the work included all payments of whatever nature with the exception of overhead costs of the contractor, including financing expenses.

The union scale of wages prevailing in the locality of the work under consideration as of June, 1917, was agreed upon by the Secretary of War and the President of the American Federation of Labor as the scale for the camp. Rules in reference to overtime and for the regulation of hours of work were agreed upon in advance between the constructing quartermaster and the contractor, in accordance with conditions prevailing in the district where the work was done.

The question of whether or not the Government got a fair return on its investment depended largely on the adequacy of the auditing and checking system which the constructing quartermaster carried out on the job. There is no room for doubt as to the wisdom of the U. S. military establishment having acted wisely in adopting the cost-plus form of contract for its emergency work. Speed was of vital importance. Abnormally high speed always means abnormally high cost. But in this war emergency abnormal construction costs were of no significance as compared with the saving in blood and general war cost which resulted from such construction speed.

In this connection it is well to recall that the government, through priority arrangements, had the benefits arising from the commandeering not only of materials and of labor, but also of transportation. Such benefits do not attach to peace time work in any field.

General Considerations Regarding Contract Work

On contract work engineers should not be compelled to do the work of both the engineer and the contractor because contractors should be more capable than owners or their representatives to handle advantageously and economically the details of construction requirements. Contracts should therefore be drawn in such a manner as not to limit the work and responsibility of the contractor to the furnishing of labor and to the execution of details under the absolute direction of the owner and his engineer. Responsibility for good construction and final excellency of the work should rest with the contractor.

To insure satisfactory results from cost-plus-lump-sum agreements, the contracts should provide for the reimbursement of the contractor for all amounts actually spent by him, such expenditures being limited in the case of materials to their normal market value and for labor to price schedules of local labor unions. The lump-sum fee allowance should include the services of the works superintendent and hand tools and such small equipment as would obviously be required for the work. For plant equipment such as machine tools, excavators, cable ways, etc., a per diem rental under stipulated conditions should be fixed or bids should be received. To prevent disputes, the plans and specifications should be as carefully prepared as for other types of contract.

Examples of Cost-Plus-Lump-Sum Agreement

Good examples of cost-plus-lump-sum agreements are found in the U. S. Housing Bureau and other government contracts which provide for a rental price for plant equipment and a contractor's fee for services, on all of which bids were taken from a list of acceptable contractors. The plant equipment fee covered the rental of all machinery, scrapers, scaffolding and tools, and all material which did not enter into permanent work. It did not include, however, lumber for temporary forms, concrete centering or the bracing and supporting of these forms or light staging or scaffolding on the exterior of structures.

The contractor from his fee was obliged to pay all costs of transporting, loading and unloading the plant equipment, and all upkeep and maintenance charges, fuel, oil, office overhead and general superintendency. A bonus was allowed the contractor, in addition to the lump-sum fee which he bid, to the amount of one-fourth of any saving he was able to make as compared with his accepted estimated cost of the total work. Under this agreement the contractor financed the entire construction work and was reimbursed by the owner for all such cost. A very strict system of inspection and accounting was maintained by the government.

Profit sharing methods have considerable merit over the straight cost-plus forms in that they give the contractor some incentive to keep the cost of the work down. A method which has been used with considerable success in Canada is described by Mr. R. O. L. French. By its terms the contractor receives 20 per cent. of the estimated cost and rebates to the owner 10 per cent. of the actual cost.

Contract Adjusted to Varying Labor Prices

Mr. Morris R. Sherrard, chief engineer of the North Jersey District Water Supply Commission, in a recent contract for the construction of the Wanaque dam, provided for an adjustment of certain labor costs after the year 1920, provided such costs are 10 per cent. above or below normal 1920 prices. This places the burden of changes in material costs on the contractor, but causes the owners to share with the contractor unusual changes in labor costs. The advantage of this type of contract as to labor over cost-plus agreements lies in the fact that the contractor is compelled to exercise the same careful supervision and that there is the same necessity for economical construction methods as is required on lump-sum and unit-price agreements, but he is not obliged to shoulder all responsibility for unexpected price changes.

In the Wanaque dam contract, labor is a controlling item, but on ordinary construction work, particularly on comparatively small jobs, and where the value of labor and material are more nearly equal, there would be less advantage in it. To be more generally applicable the adjustment in prices should, if possible, include material as well as labor, and, furthermore, the length of time between successive adjustments should be made to conform to the size of the contract and to the probable duration of construction.

The adjustment of prices is more difficult in the case of materials than of labor, because of the greater number of materials, and also because of the variety of materials which might satisfy any particular specification. On this account the furnishing of the principal materials to the general contractor through separate contracts made by the owner may be advantageous in that the risk would be more widely distributed and the adjustment of prices made somewhat more simple and definite.

At a time when transportation facilities are abnormally inadequate the assumption by the owner of the responsibility of furnishing materials cannot eliminate wholly the troubles arising from the enforced intermittent use of the contractor's laborers.

Summary and Conclusions

1. Pre-war construction contracts were for the most part, and rightly so, agreements on a lump-sum or a unit-price basis. Cost-plus contracts were used only on certain large work done for private corporations or as a part of other types of agreements.

2. During the war the United States Government construction and much other work was done on a cost-plus basis. Where proposals on a lump-sum or unit-price basis were obtained, the prices were intended to be sufficiently high to insure against loss due to constantly changing prices and the scarcity of labor and material.

3. Since the war, the procedure has been somewhat unsettled, with an effort to do away with some of the disadvantages of cost-plus form and to combine so far as possible the good qualities of both types of contracts.

4. The unit-price contract under normal stable market and transportation conditions is the most satisfactory. The lump-sum contract is principally advantageous in that the final cost is definitely known at the outset.

5. Cost-plus contracts, with proper provision for accounting and supervision, may be satisfactory where conditions are not definitely known and in the case of private corporations where well-qualified contractors may be selected to work under adequate supervision. Under war conditions, cost-plus contracts were necessary and even now have many advantages.

6. Construction work for private corporations may be successfully carried out with proper safeguards under any of the discussed forms of contract. For general construction work under municipal control, the nearer a contract approaches the well-established lump-sum or unit price contracts, if indeed any departure from such contracts is legal, the more satisfactory will be the results secured.

7. Until such time, however, as the material and labor markets are better stabilized, contracts should, in fairness, place the burden of uncertainty on the owner and not on the contractor. This may be done as follows:

   (a) For much municipal work, a form of contract may be adopted along the lines proposed by Mr. Sherrard, and modified as suggested as to labor and material adjustments at proper intervals.

   (b) For municipal or other work, contracts may provide for the furnishing by the contractor of such labor and materials as are reasonably stable, with adjustment for changes in the labor market, and with materials of unstable price furnished by the owner through separate contracts.

8. Construction work not absolutely necessary should be deferred, and materials and labor should be diverted so far as possible, to work which is absolutely necessary.

9. So far as possible necessary improvements should be made repairing or enlarging present works, and new works should be confined for the present to immediate needs.

Discussion on Mr. T. J. Lafreniere's Paper

(See page 626)

In the discussion which followed the reading of Mr. Lafreniere's paper, Mr. J. N. Chester commended the policy in vogue in the province of Quebec as outlined by the author of the paper and especially approved of the powers given to the Quebec Superior Board of Health and the Public Utilities Commission. Legislation of this character which could enforce the improvement of water supplies and provide loans at a low interest rate for the betterment of water supply plants was, in his opinion, an idea that could safely be copied by the majority of states on the American side of the line. Mr. Lafreniere, in reply to a question regarding the limit of the proposed loan, explained that it was felt that loans of this character were just as important, perhaps more so, than loans for road construction and the province of Quebec had, in this latter connection, set an excellent example by lending money to municipalities at a very low rate of interest. To an even greater extent was it desirable for the province to loan money on somewhat similar terms to municipalities seeking to improve the general health of the people by improving the water supplies and plants. In regard to the constitutionality of the powers of the Superior Board of Health, Mr. Lafreniere stated that he had no reason to be in doubt. These powers have already been tested in the court in connection with the city of Hull, which was ordered by the Board of Health to install a filtration plant and which refused to abide by the order. The court, however, has decided that the city must comply and the effect of this decision is seen in the fact that of three cities which were withholding compliance with the Board's order pending the above decision, two have already voluntarily started work on the improvement of the water supply. Mr. Wynne-Roberts enquired as to the apportionment of cost when private water works corporations were ordered by the Quebec Public Utilities Commission to undertake improvement, in which case a franchise probably prevented the increase in the water rates. Mr. Lafreniere replied that the law as yet is new and has not been tested, but the object of the Act is to allow the cost to be properly apportioned with due regard for the rights of both the municipality and the private corporation. Mr. Lafreniere also explained that, at the present time, no private corporation is given a charter to supply water from a polluted source, but prior to 1901 many private corporations were given charters and permitted to supply water without due regard for sanitation. The law was especially constructed to apply to such cases where any extensive improvement would result in heavy burdens to the water works corporation.

Calgary Branch E. I. C. To Hold Western Professional Meeting

THE Calgary branch of the Engineering Institute of Canada has decided to hold a Western professional meeting at Banff in August. While it it is regretted that the parent society cannot take part owing to two Eastern professional meetings in September and October, it has been decided to act upon their suggestion and hold an independent meeting and it is earnestly hoped enough members will be able to attend to make the meeting a grand success. The following committee has been appointed to make all arrangements:—

G. W. Craig, M.E.I.C., Chairman, City Engineer of Calgary; F. H. Peters, M.E.I.C., Commissioner of Irrigation, Calgary; J. M. Wardle, A.M.E.I.C., Supt. Rocky Mountain Park, Banff; A. S. Dawson, M.E.I.C., Chief Engineer, Dept. Nat. Resources, C.P.R., Calgary; A. I. Payne, M.E.I.C., Engineer, P. Burns Co.; G. N. Houston, M.E.I.C., Asst. Commissioner of Irrigation; F. K. Beach, A.M.E.I.C., Div. Hydrometric Engineer; Wm. Pearce, M.E.I.C., Statistician, C.P.R. Dept. of Colonization and Development; A. L. Ford, M.E.I.C., Chief Hydrometric Engineer, Calgary; R. C. Harris, A.M.E.I.C., Div. Engineer, C.P.R.; F. E. Emery, A.M.E.I.C., Secy. Western Professional Meeting.

Mr. J. M. Wardle, A.M.E.I.C., Supt. of Rocky Mountain Parks, at Banff, has kindly arranged with the government for the use of military bell tents and clean blankets; cots and mattresses will also be supplied under arrangements of the Calgary branch.

Arrangements are being made to serve meals in camps, and therefore the cost will be much less than at the hotels. Any who wish to make reservation at hotels are at liberty to do so. The camp is located on a beautiful spot about 500 yards east of the C. P. R. Banff Springs Hotel, on the bank of the Bow River and less than five minutes' walk from the Golf Course.

The tentative program provides for professional meetings during the mornings and possibly evenings with the afternoon devoted to pleasure and sight seeing.

The camp will be open on Saturday morning, August 14th, for any who wish to spend the week-end in Banff, but sleeping accommodation will be available Friday night, August 13th, for any arriving that date. Professional meetings will begin Monday morning, August 16th, and conclude Wednesday night, August 18th; camp will be broken up Thursday night, August 19th.

The members of the Engineering Institute of Canada and members of the Association of Professional Engineers, Mining Institute, Association of Architects and Land Surveyors of Alberta, British Columbia, Saskatchewan and Manitoba, with families, are cordially invited to attend, providing the secretary is notified not later than July 25th in order that accommodation may be arranged for all.

The Cost

The regular summer rate on the C.P.R. from following points to Banff and return are:

Winnipeg, $56.16 including war tax; Regina, $36.20; Saskatoon, $31.15; Edmonton, 14 days, $14.55; Vancouver and Victoria through Banff to Calgary and return through the Crow's Nest Pass, good for stop-over in Banff, is $55.55.

Meals and accommodation at the camp will be provided at actual cost which is expected not to exceed $3.00 per day per person, and if at all possible will be kept lower.

Excursions will be arranged—horseback, auto, tally-ho or walk. Boat trips for small parties can also be arranged and visitors may avail themselves of hot sulphur baths at the C. P. R. hotel, cave and basin or sanitarium baths.

Owing to the fact that this is not a money-making scheme, a cash advance will be required from each person on registration, of $3.00 per day from time of his arrival to breaking up of camp. Refund will be made for unexpired period if visitor does not stay for full period. Five dollars of this goes toward incidental expenses of the meetings. Visitors who stay at hotels will be requested to make payment of $5.00 on registration to cover incidental expenses of meeting.

Refined Tar in Construction and Maintenance

By A. F. Macallum*

THE construction of refined tar pavements is of comparatively recent occurrence in Canada. Before tar was brought to a certain consistency, ordinary tar pavements had been laid in several cities for a number of years, probably the first of these being in Hamilton, Ont. These old tar pavements, having the tar and stone mixed on boards somewhat like the method used for the original concrete bases of asphalt pavements, were fairly satisfactory but were uneven in their wearing qualities on account of the variations in the tar used. This variation in the quality and density of the tar caused holes to form where the tar became brittle and had been burnt. These places became apparent a year or two after construction, creating an excessive amount of maintenance on streets of comparatively heavy traffic. A redeeming feature, however, in these old tar pavements was that they made, in most cases, an excellent base for surfacing with asphalt or other topping after they had ceased to have a comparatively smooth surface.

The refining of tar for road purposes began about 1902 and quickly developed into an excessive industry, subject to scientific control. The tars available are roughly classified into coal tars and water gas tars which differ essentially in physical and chemical characteristics and the resultant road tars made from them show similar variations.

On account of water gas tar having to be modified with other bitumens to make a suitable road tar, most of the road tars are made from coal tars. The crude tars are refined for road tars by dehydration, blending and distilling. The tars from different gas works, after settling, vary greatly in their contained percentage of water from 2 per cent. to 10 per cent. Different tars of known qualities are then blended or mixed to get a uniform product or a product fulfilling some definite specification and this blending requires an absolute knowledge of the different tars used and of their action in distillation. In distilling, the water and light oils are first driven off, next the carbolic oils come over and finally the heavy oils. For light road oil, distillation is stopped early and for binder purposes the distillation is carried further.

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*Before Canadian Good Roads Association.

Mainly Constructional

East and West—From Coast to Coast

The Department of Marine, Ottawa, is calling for tenders for the construction of a reinforced concrete tower at Carmanah, B. C.

The County Council of Brant, Ont., has voted the sum of $160,000 for the construction of new roads throughout the county.

The Warren Bituminous Paving Co. of Toronto was recently awarded the contract to lay bitulithic pavement in Walkerville, Ont., at a cost of $80,000.

The item of $100,000 for the bridge at Banff, Alta., and also a vote of $2,150 for repairs to the old bridge, were carried by the House of Commons at Ottawa, recently.

A contract was let recently at Montreal for a $400,000 school, to be known as the Devonshire School. The site of the new school is on Clarke, Cuthbert and Arcade streets.

The ratepayers of West Kildonan, Man.. recently passed a by-law authorizing the expenditure of $100,000 on the purchase of a school site and the erection of a school thereon.

Applications for housing loans received by the superintendent of the governments housing scheme in British Columbia exceed the provincial allocation by over half a million dollars.

The Provincial Board of Health, of Ontario, has ordered the construction of a filtration plant at Smiths Falls, of either the rapid sand, slow sand or drifting sand type, without delay..

Plans for a $75,000 plant for the Dominion Oxygen Co. to be erected at Winnipeg, have been approved by the civic works committee. The company will manufacture oxygen for welding purposes.

The Windsor Civic Housing Commission, Windsor, Ont., has awarded the contract for the construction of fifty houses on Bruce Avenue, to Mr. R. W. Westcott. These houses will be sold at $4,500 with an initial payment of 10 per cent.

The ratepayers at Winnipeg passed by-laws recently providing for the expenditure of approximately $1,500,000 on schools, also a by-law for $279,000 for a municipal hospital. The $300,000 Maryland bridge by-law, however, was defeated.

The contract for the filling and excavation on the site of the proposed Ballantyne pier at Burrard Inlet, Vancouver, B.C., was let yesterday by the Board of Harbor Commissioners to the firm of Grant & McDonald, at a price of $513,121. The work will take from seven to ten months to complete.

A permit was issued recently at Montreal to the Famous Players Co. for the erection of a new theatre on Cathcart and Mansfield Sts. The building will be of brick construction, 165 ft. by 90 ft., and will cost in the neighborhood of $300,000. The Atlas Construction Co. are the contractors.

The voters at Westmount, Que., recently carried a by-law authorizing the city to borrow $750,000 for civic improvements, and another by-law to raise the sum of $80,000 for providing additional park space and the purchase of part of the Monk estate as a possible site for a new city hall.

A new firm to be known as the St. John Welders & Engineers, Ltd., has been organized at St. John, N.B., and will carry on the business of oxy-acetylene and electric welders, machinists and engineers. The personnel of the new company is comprised of Mr. J. B. Barrett, president, who has been for twelve years a chief engineer in the British Navy; Mr. L. J. Gallagher, managing director and secretary-treasurer, who has been throughout the duration of the war consulting and travelling engineer for the Imperial Munitions Board, and Mr. K. J. MacRae, of the firm of MacRae, Sinclair & MacRae, barristers, who is vice-president of the company.

The special committee of the Board of Education of London, Ont., appointed some time ago to report on the construction of a new Collegiate Institute, have adopted a recommendation that the new structure be erected on the old site, and that it be a building of not less than 36 class rooms, at a cost of $500,000.

At a meeting of representatives of the municipalities in the Trent Valley Canal district, held recently at the Empress Hotel, Peterboro, Ont., an association to promote trade and tourist traffic along the above waterway was organized. Mr Fraser, of Peterboro, was appointed president of the new organization, which will be known as the Trent Valley Development Association.

Mr. G. L. Guy, a member of the Utilities Commission, at Brandon, and Mr. Wm. Scott, engaged by the city council to make a survey of the waterworks system of the city, in making their report, recommend the installation of an electric plant for the electrification of the system, the building of a sedimentation basin and the cleaning out of the dead-ends and cross-sections of the system.

The Board of Trade at Kingston, Ont., has received word from the Dominion Public Works Department that authority has been given for the removal of 41,533 cu. yards of material in Kingston harbor, and that tenders will be called immediately. The dredging will be carried out on an area extending from the Canadian Locomotive Works to the Montreal Transportation Company's frontage and a depth of ten to sixteen feet will be obtained.

The City Council at Hamilton has adopted City Engineer Gray's scheme for the reorganization of the Works Department. This scheme includes the placing of the garbage and salvage collections under Mr. James Weeden, street commissioner; the appointment of Chief Engineer James Bain as mechanical superintendent, to look after all city machinery; promotion of Mr. Charles Stewart to the post vacated by Mr. A. P. Kappele, secretary of the works department, and the appointment of a new buying clerk.

Personal

Mr. Chas. Yeates has been appointed to fill the vacancy caused by the resignation of Mr. J. W. Oakes from the Housing Commission at Guelph, Ont.

Mr. H. L. F. Blake, C.E., the well-known explorer, left Quebec city recently, accompanied by Mr. Kernichy, mining engineer of Montreal, to continue his exploring operations in the Ungava district. Mr. Blake is in the employ of British interests.

Mr. William Robertson, contractor of Chatham, Ont., is leaving that city in the near future and will take up residence in Los Angeles. Mr. Robertson is one of Chatham's oldest contractors and has been connected with the erection of many of the city's buildings.

Mr. Thos. S. Scott, professor in civil engineering, Queen's University, Kingston, Ont., has resigned. Prof. Scott has been at Queen's since 1915, with the exception of a year in Halifax, during the war, with the Royal Canadian Engineers. He is taking over the supervision of some road construction work in the neighborhood of Brockville, Ont., for the summer.

Obituary

Mr. John Niebergall, engineer of Vancouver, B.C., died recently in St. Paul's Hospital, after a week's illness. He was born in Ontario 69 years ago.

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